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DISEASES OF THE JOINTS AND SPINE



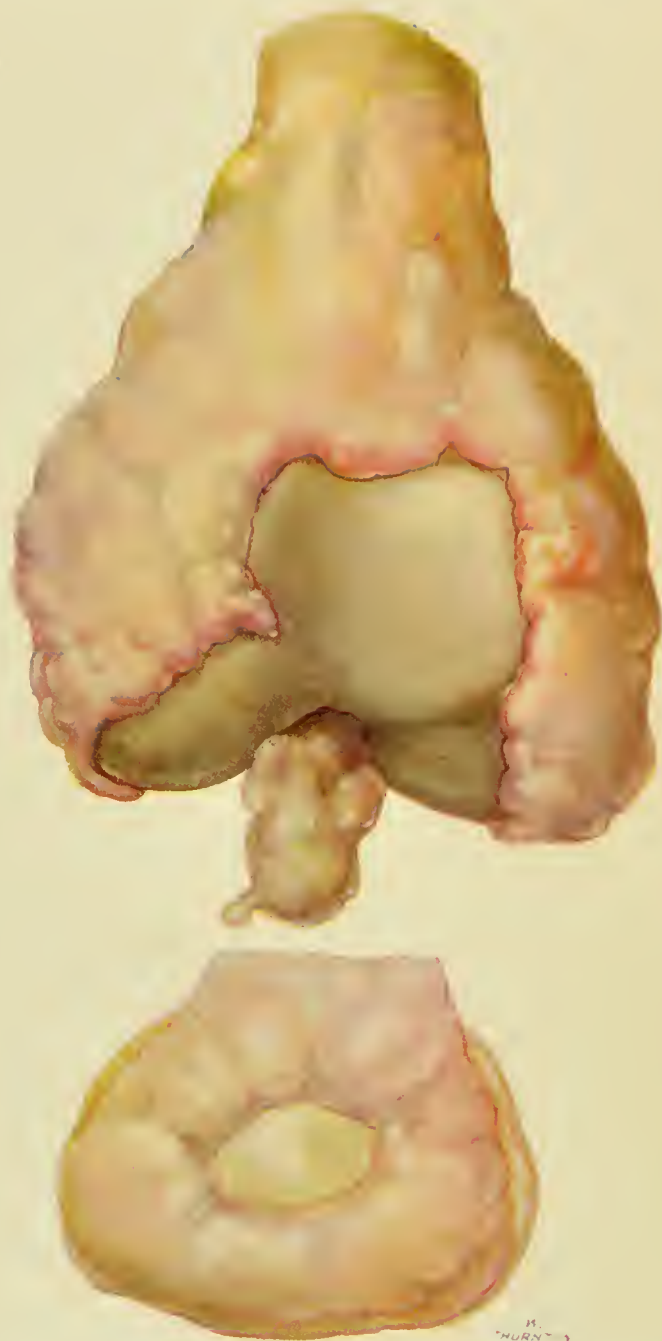


PLATE 1.—TUBERCULOUS DISEASE OF THE SYNOVIAL
MEMBRANE OF THE KNEE-JOINT.

The articular cartilage is not eroded, but the margins of the cartilage on the femur, and more especially on the patella, are encroached upon by the thickened synovial membrane.



DISEASES OF THE JOINTS AND SPINE

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NEW AND ENLARGED EDITION

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Fistula

WITH 4 COLOURED AND 8 BLACK-AND-WHITE PLATES, AND
UPWARDS OF 100 ILLUSTRATIONS IN THE TEXT

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PREFACE TO THE THIRD EDITION

SINCE the second edition of this work appeared, our knowledge of the infective forms of arthritis has considerably increased, and two entirely new chapters dealing with this subject have been introduced under the headings of Arthritis in Specific Infective Diseases and Septic Arthritis.

Recent advances in the study of intermittent hydrarthrosis and coxa vara have led to the inclusion of chapters on these two subjects.

The chapter on osteo-arthritis has been largely rewritten under the title of Arthritis Deformans, which embraces rheumatoid arthritis, osteo-arthritis, and hypertrophic osteo-arthropathy.

Some revision has been called for by the extensive use which is now made of radiography in the diagnosis of diseases of the bones and joints. The place of vaccine-therapy in the treatment of diseases of the joints has also received careful attention.

To make way for this large amount of new material without too greatly increasing the size of the volume, some of the case-narratives have been omitted. The arrangement of the chapters has been somewhat altered ; and many new illustrations have been added, including four coloured plates and a number of radiograms.

It was the Author's endeavour, when this volume was first written, to record his personal experiences, mainly from a clinical standpoint, and to give an account of any contributions which he had been enabled

to make towards the recognition and treatment of the diseases under consideration; and those aims have been kept in mind in the later editions. In preparing the present edition he has enjoyed the co-operation of Mr. C. Gordon Watson, who has spared no pains to bring the volume up to date while preserving its original features.

The Author's thanks are also due to Mr. Girling Ball for his contributions on vaccine-therapy and his assistance in the reading of the proofs, and to Dr. Rupert Waterhouse for the section on hypertrophic osteoarthropathy.

DOWNING COLLEGE, CAMBRIDGE

September, 1910.

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DISEASES OF THE JOINTS AND SPINE

PART I.—DISEASES OF THE JOINTS

CHAPTER I

SYNOVITIS AND INJURIES OF JOINTS

Simple synovitis.—By simple synovitis is understood an inflammation of the synovial membrane which is not dependent upon any specific infection nor associated with any definite disease, and is not set up by any disease of the contiguous structures.

The chief cause of this form of synovitis is some mechanical injury, such as a contusion, or a wrench, or the pinching of an indurated synovial fringe, a loosely attached semilunar cartilage, or a loose body, between the articular surfaces.

The changes which take place in the synovial membrane are in all respects similar to those met with in inflammation of any of the connective tissues. The membrane in acute cases becomes intensely vascular, and assumes a bright-red tint, which appears at first sight to be uniform, but on closer inspection is seen to be due to the presence of a collection of innumerable turgid blood-vessels. Later, the surface presents here and there patches of extravasated blood, each indicating the site at which an over-distended vessel has given way. The appearance of the synovial membrane in

this stage is very striking, for its bright-red colouring is set off by the pearly white of the articular cartilage. Very soon after the vascularity commences, the membrane swells and becomes soft, succulent, and juicy. The swelling is greatest in the situations of the normal folds, where the membrane passes from one articular surface to another, and by the swelling in these situations the edges of the cartilages are encroached upon and overlapped to a greater or less extent.

Under microscopic examination, the changes seen correspond with those already described as visible to the naked eye. The blood-vessels dilate, and fresh capillaries are formed. Exudation occurs into the perivascular spaces, and these become distended by the excess of serous fluid with which they are soaked. Leucocytes escaping from the dilated vessels, and collecting in the soft connective tissue beneath the endothelium, penetrate between the endothelial cells and reach the internal surface of the joint. Here and there a vessel gives way and allows the escape of its contained blood. In many cases the fibrin-forming elements do not leave the vessels, and the fluid exudation is simply serous; but in cases of greater intensity a plastic exudation takes place, and, the fibrin coagulating in the subsynovial tissue, the inflammation assumes a plastic character.

The endothelial cells also take part in the general cellular activity. They multiply with more than usual rapidity, and in many cases are cast loose into the joint. When the multiplication of cells is rapid, none of them attain their full size and development before they are displaced to make way for fresh cells, which are constantly being pushed to the surface from below.

Changes in the synovial fluid.—The changes in the synovial fluid are in proportion to those which occur in the membrane itself.

At first the fluid is simply increased in amount, but the synovial secretion rapidly becomes diluted with the products of inflammation, so that the joint is distended with a mixture of synovia and serous exudation. This fluid is quite clear in the early stage, but as the inflammation progresses flakes of fibrin make their appearance, and in many cases a membranous layer is deposited upon the synovial surface, giving it an opalescent or cloudy hue.

Mingled with this fibrinous exudation are the cast-off endothelial cells, and the leucocytes which have penetrated to the joint-cavity.

In all acute inflammations the synovial fluid is coloured to a greater or less extent by extravasated blood, and red blood-corpuscles are found on microscopic examination.

In its physical characters, synovial fluid from a case of acute synovitis is red, sticky or viscid, and opalescent.

It should be mentioned that, in cases of injury, a definite extravasation of blood is not infrequent at the time of the accident. In most cases this effused blood is rapidly mingled with synovial fluid and with the products of inflammatory exudation, and does not coagulate for some time, if at all.

If a simple acute synovitis undergoes resolution, the cell-proliferation ceases, the exudation-fluid is absorbed, the newly formed vessels shrink and disappear, the softened and infiltrated tissues resume their natural appearance, and the membrane and its secretion again present entirely normal characters.

When in neglected cases acute synovitis merges into the chronic form, the appearance of the synovial membrane is but little altered from the normal, the only marked change being that, on account of the excess of fluid in which it is bathed, the membrane is swollen and succulent.

Microscopically, in chronic synovitis there is seen to be some cell-exudation, but this is at all times slight. There is generally some increase of vascularity, though this is never a marked condition. As time goes on, further changes may ensue, and the synovial membrane may become thickened and indurated by the gradual formation in its substance of fibrous tissue developed from the cells already mentioned. In the majority of cases of simple chronic synovitis, however, recovery will finally result.

The changes that occur in the synovial fluid are not of a very marked nature. The amount is increased by the addition of a large quantity of serous exudation; this fluid is not opalescent, for there is little or no cell-exudation; and no fibrinous coagula, such as are met with in acute synovitis, are present. Albumin is generally present in considerable quantity. As the name implies, the process at work is a chronic inflammation of the synovial membrane, and the gradual thickening of tissue and the increase of fluid are changes analogous to those which occur in other chronically inflamed parts.

Symptoms.—Simple acute synovitis is often met with in a characteristic form after a contusion or wrench. The patient is attacked with pain in the joint. At first only moderate, this rapidly becomes severe, especially at night, and is of a tense, bursting character. The joint, placed in a posture of “greatest ease” (p. 6), becomes fixed in this position, and any attempt at either active or passive movement causes severe suffering. The swelling varies in amount, but is usually considerable. It takes the general shape of the joint, the synovial cavity of which becomes distended, and clearly marked out in such superficial articulations as the knee and elbow. Bulging, however, is most distinct where the capsule is thin, as in the intervals between the tendons and ligamentous expansions which traverse the surface.

Heat is a very important symptom in the case of the elbow, wrist, knee, and ankle ; it is not, however, available in the instances of the shoulder and hip, as these joints are so thickly covered with soft parts. Heat may be gauged by comparing the temperature of the suspected joint with that of its fellow, under similar conditions of exposure, by placing the hand flat on the surface. In slight cases an increase of temperature may be the most distinct evidence that synovitis is present ; while, on the other hand, if a joint superficially placed is perfectly cool, this circumstance is of itself enough to show that no acute inflammatory action is in progress. Redness of the superjacent skin is present in severe cases, but it is generally slight, and often entirely absent. Tenderness is frequently so great that the weight of the bed-clothes or the slightest pressure cannot be borne. Fluctuation, when effusion has taken place, is readily detected, and in the knee riding of the patella can be felt. Muscular wasting becomes well marked.

Chronic synovitis is accompanied in some instances by the additional symptom of a large increase of effusion into the joint-cavity ; in others, considerable fibroid thickening of the synovial membrane, suggesting tuberculosis (*see* p. 41), takes place ; in others, again, a creaking sensation on movement may be felt.

Prognosis, in cases of *simple synovitis* in which judicious treatment is adopted, is generally quite favourable. In healthy subjects, joints, like other parts, may be depended upon to evince a strong tendency to repair when favourable conditions are secured. It may be useful to emphasise this, for it is not rare to see a knee, for example, after an injury, kept in a fixed position, or carefully strapped, or enveloped in a firm bandage or a knee-cap, after all the evidences of inflammation have disappeared. This treatment is employed under the

impression that a joint, when once injured, is likely, for a long period, to resent even moderate use. Experience, however, will show that recovery is promoted—when the heat and swelling have subsided—by moderate exercise combined with douching and massage; * while prolonged rest and compression impair nutrition, induce muscular wasting, and render the joint weak and irritable. Even if exercise is followed by a slight return of heat and swelling—provided, as will usually be the case, these symptoms disappear after a night's rest—moderate exercise and massage will still be right, and need be interrupted only when the swelling and heat do not readily pass off.

Treatment of simple acute synovitis.—The first and most important step is to place the joint in good position, and to keep it at complete rest by means of some comfortable appliance. (*See the various joints under their respective headings.*) When attacked with inflammation the joints are instinctively placed in the position of “greatest ease”: thus, when the shoulder is affected, the arm remains at the side; the elbow, wrist, and knee are fixed at an angle of 140° to 120° ; in the case of the hip the limb is flexed, abducted, and slightly rotated outwards; the ankle is slightly extended. When the injury has been severe these positions must be amended without delay. Unless this is done, stiffness in a faulty posture of the limb may give rise to serious trouble. The change must be effected gently, and to accomplish it, both in order to save pain and to secure muscular relaxation, it may be advisable, when the larger joints are concerned, to employ an anæsthetic, especially in the case of children. In slight cases, however, it is unnecessary to make any immediate attempt to alter the position of the limb. It will be enough to enclose it in well-

* *See* Chap. XXXVI., Movement and Massage.

fitting splints, or to place it on a pillow in the posture to which the disease has brought it. For, with a few days' rest, muscular rigidity will pass off, and the limb can be easily brought into, or will naturally assume, a good position.

The elbow and wrist can be satisfactorily supported in a well-moulded leather or poroplastic splint and a sling; but whenever one of the large joints of the lower extremity is acutely inflamed the patient must be kept in bed, and the limb maintained at rest by some suitable apparatus. To relieve hyperæmia, and thus reduce tension and pain, an evaporating lotion or an ice-bag will be useful. Should the joint be tensely swollen, the fluid should be drawn off with a sterilised tubular needle connected with an exhausting syringe. The removal of two or three drachms of fluid will often give immediate relief. If necessary, a hypodermic injection of morphia should be given.

Treatment of chronic synovitis.—Here, as in the acute form, the first indication is to secure rest. The joint must be fixed in a well-fitting splint. (*See under the various joints.*) Blisters, about an inch and a half square, are very serviceable. They should be used in succession, at intervals of three or four days, one healing before the next is applied. In obstinate cases they should be continued in a series for two or three weeks. When fluid remains in any quantity after the blisters have been used it may often be got rid of by uniform pressure, best obtained by an elastic rubber bandage, which, however, must be carefully applied so that undue compression is avoided; or the joint may be covered with the unguentum hydrargyri compositum, or the unguentum hydrargyri, spread on lint and then strapped with narrow pieces of soap plaster, and over this dressing the elastic bandage may be applied.

The period during which rest is advisable must be

carefully considered in each case. In the past it has undoubtedly often been quite unnecessarily prolonged, with the result that the joint has become stiff and the muscles have undergone extensive atrophy, especially if splints have been used. It can only be said in general terms that rest must be continued as long as there is either heat or pain in the joint, or while either of these symptoms or an increase of stiffness is produced, in any marked degree, by exercise. As recovery advances, the joint may be douched with hot salt water, and passive movements, slight at first, and gradually increased, may be combined with massage and exercise; but these must be closely watched, and they should be discontinued if either pain or heat that does not quickly subside, or increased stiffness, is observed. The question of endeavouring to restore movement in joints that have been inflamed is discussed in Chapter XXXVI.

Acute suppurative arthritis.—Septic arthritis, apart from general blood-infections (p. 126), may either result from a wound directly involving a joint, or may be due to the spread of suppuration from neighbouring parts. Thus acute suppurative arthritis of the hip is occasionally produced by the bursting of a psoas abscess into the joint. In two instances it was apparently caused by the tunnelling of pus under the periosteum, and its entrance into the articulation, from a subperiosteal abscess situated at some distance down the femur. In one, an abscess, due to tuberculous periostitis at the junction of the uppermost with the middle third of the femur, in a boy of 9, was opened, and soon healed, and the boy left the hospital apparently quite well. A fortnight later he was readmitted. The abscess had refilled, and a few hours previously he had been seized with acute pain in the hip. Profuse suppuration followed, the joint became disorganised, and he ultimately died of exhaustion. A boy of 13

had an abscess in the middle third of the thigh, connected with a circumscribed tuberculous deposit in the shaft of the femur. The abscess was opened and the cavity scraped, and the boy left the hospital convalescent. Six weeks later he returned. The abscess had refilled, and he now had intense inflammation of the hip. Free suppuration occurred. Some weeks later the head of the femur, which had necrosed and become a loose sequestrum, was removed from the cavity of a large abscess. The patient recovered, but the joint remained permanently stiff.

Acute suppurative arthritis following disease in the growing end of one of the bones forming the joint has been separately described (Chapter III.). A full account of suppurative arthritis following general blood-infections will be found in Chapter VIII., Septic Arthritis.

Morbid anatomy.—In whatever manner the affection has been brought about, the changes that occur in acute suppuration of a joint are tolerably uniform. The chief differences depend on the rapidity and severity of the inflammation. In a simple case, caused, for example, by a punctured wound, through which infective material has gained an entrance, the synovial membrane is the tissue most evidently affected in the early stage. This becomes so vascular that it assumes a bright-red colour, swells, and presents a soft, succulent, and gelatinous appearance on section. The endothelial surface is dull and opalescent; it gradually loses its smooth polished aspect, and becomes covered with shreds of fibrin; subsequently it becomes converted into granulation-tissue. The synovial fluid is increased in quantity, and rapidly becomes opalescent from admixture of flakes of fibrin. Very shortly it acquires a milky appearance, from the presence of pus-cells, and finally it assumes a distinctly purulent consistence: in the more acute cases it is often blood-stained, as the result of minute

hæmorrhages from the intensely injected synovial membrane.

The cartilages lose their pearly-white colour, and present a bluish tint. Soon they become permeated with blood-vessels, and ulcerated in patches, so that the subjacent bone is extensively exposed (Fig. 1). Here and



Fig. 1.—Acute suppurative arthritis of the knee.

(From a specimen, No. 567D, in St. Bartholomew's Hosp. Mus.)

there flakes of cartilage undergo necrosis, and are cast off as loose shreds into the articular cavity. The ligaments become infiltrated and eroded, and soon completely give way, so that the joint surfaces undergo displacement. The articular ends of the bones are, like the other structures, inflamed, and are more or less extensively destroyed by ulceration. The

periarticular tissues share in the general inflammation. Abscesses rapidly form in them, and frequently, from the first, communicate with the cavity of the joint. These collections of pus are often very large, and tend to burrow widely among the surrounding muscles, so as to make their way, when, e.g., the knee is the joint affected, both upwards in the thigh and downwards in the leg for a considerable distance. Suppuration in

cases of acute arthritis is profuse, and the tendency of matter to track its way in the intermuscular spaces rather than to approach the surface is a marked and important feature.

The destructive effects of this condition are shown in the accompanying figure (Fig. 1).

The progress of a case such as this, unless energetic treatment is at once adopted, is generally from bad to worse. The usual result, as far as the joint is concerned, should the patient recover, is the formation of bony or close fibrous ankylosis. This is brought about as follows: The intensity of the inflammatory process subsides, and the production and multiplication of cells become limited; while the cells which remain in the various structures, whether bone, ligament, cartilage, or synovial membrane, become gradually developed into fibrous tissue, in which, where it is in contact with osseous tissue, bone-salts are subsequently deposited. The new blood-vessels shrink and disappear, the fibrous tissue which is not ossified contracts, and the joint, as such, ceases to exist, its cavity being entirely obliterated. In instances, however, in which treatment is adopted early, and in which the bones have not become exposed and carious, a more or less movable joint is left; while, should the secreting surface of the synovial membrane not have been destroyed, and should the cartilage and ligaments be still intact, the patient may preserve a useful and movable articulation, although some thickening and weakness remain.

Symptoms.—In a typical case, one of punctured wound of the knee being the example selected for description, a few hours after the injury the joint is the seat of pain, which soon becomes intense, especially on any attempt at movement, and of quickly increasing swelling. The temperature rises to 102° or 104° , the pulse to 110 or 120, and the patient feels ill and depressed.

Sometimes a distinct rigor occurs. Very soon the joint is distended, exquisitely tender and hot. The skin becomes dusky, and may pit on pressure. The temperature remains high, and there are further rigors. Within the next twenty-four hours, or still more quickly, the occurrence of suppuration is indicated by increasing illness, and a further rise of temperature and pulse, together with increased pain and tension in the joint, a deeper blush on the surface, and œdema of the surrounding parts, often involving the limb for some distance above and below the joint.

Should the case be allowed to take its course the local mischief increases, matter bursts through the distended joint-capsule, and is extravasated into the limb; the patient rapidly wastes, and becomes feeble and prostrate; the tongue is dry and brown, delirium comes on, and death occurs by exhaustion following general blood-poisoning, often in the form of pyæmia.

Treatment.—The treatment of suppurative arthritis will not be discussed here, but will be dealt with fully in Chapter VIII.

CHAPTER II

INTERMITTENT HYDRARTHROSIS

THIS is certainly a remarkable and, at present, a very obscure affection. It consists of a periodic effusion into joint cavities. The period varies in different cases, but each case has its own period which, in many instances, is observed with almost clockwork regularity. The time of recurrence in one case (Case 4) was daily at 6 p.m. ; in others on any day up to the thirtieth, or even later.* The most frequent dates are from the ninth to the fifteenth day. In some cases the period changes. In one it changed from the thirtieth to the ninth day; in another, from three months to eleven days; in another, from fourteen days to two days. In some cases concurrent cycles have been noted, an effusion of one joint being followed by effusion into another at regular intervals. The whole duration of the affection differs considerably in different cases. In several it extended over three, four, or more years. In other cases the attacks, after persisting for many months, ceased for some weeks or months and then reappeared—a circumstance that should be borne in mind both when prognosis is being considered and when conclusions are being drawn as to the value of any particular form of treatment. Some cases, after showing periodicity in the most definite manner, may partially lose this feature, and the attacks may become irregular, both as to the time of their recurrence and their severity and duration.

* In Pletzer's and Seligmüller's cases there was an interval of three months.

The attacks commence with a varying degree of pain, stiffness and feeling of weakness, then effusion begins and continues to increase for one, two, or three days; then it recedes, and the accompanying symptoms slowly disappear, so that the joint has returned to its normal condition on the fourth or fifth day. In some instances the effusion is moderate in amount; in others it produces painful distension. In some cases the attack is preceded by a definite "aura." In a case recorded by Garrod* a sensation as of "running water" in the knee preceded the onset of effusion.

The joint most frequently involved is the knee. Often both knees are affected, and are the only joints attacked. But all the large joints—the hip, knee, ankle, shoulder, elbow, and wrist, and even, Dr. Brackett and Dr. Cotton state, the lower-jaw joint and the joints of the spine—may be concerned. In all recorded cases, with one exception (the elbow), where only one joint has been involved, it has been the knee. The condition may be limited for some years to one particular joint, or several joints may be attacked simultaneously or alternately, or many joints may be attacked in succession.

The affection is commoner in females than in males. It does not appear that any relationship exists between the periodic attacks in women and the menstrual periods. In some cases it has been noted that the attacks have been aggravated when coinciding with the menstrual period, and in others that during pregnancy the attacks have abated. The age varies from eight to fifty years. The predominant age is about the twenty-sixth year. The condition is usually met with in joints which are otherwise normal, but in some instances periodic effusion has followed injury (Case 4); in others it has been associated with some previously diseased state, such as

* Garrod, *Quarterly Journ. of Med.*, Jan., 1910.

rheumatoid arthritis or gonorrhœal arthritis in its chronic form (Garrod).

The following examples will illustrate the condition when it occurs in joints which are otherwise apparently normal.

Case 1.—An unmarried woman, æt. 28, was admitted into St. Bartholomew's Hospital in 1903 with the history that, for eighteen months, her right knee became swollen and painful every fourteen days. The swelling, which recurred with strict regularity or periodicity, lasted for three days, and then disappeared, leaving the joint in what seemed to be a perfectly normal condition. While under observation for six weeks the patient had three attacks. Two were punctual to the day, while one, which was due on a Saturday, occurred on the Sunday—one day late. The effusion reached its acme on the second day, and then subsided, so that on the fourth day it had disappeared. The attacks were all exactly alike. The joint grew uncomfortable and stiff, the synovial cavity became somewhat tensely distended, and the superjacent skin a little over-warm. Some fluid was removed and examined. It was reported to be merely synovial, diluted with serum. Various means were tried, without benefit, but after taking small doses of arsenic, with occasional interruptions, for six months, the patient wrote (January, 1904) saying the attacks had ceased.

Case 2.—A gentleman, æt. 42, seen in May, 1904, found, at the end of 1902, that both his knees were often swollen. The attacks lasted three or four days. Between the attacks the joints appeared to be natural. He had noticed that the swelling seemed to return at regular intervals of a fortnight. I found both knees moderately distended (containing perhaps three ounces of fluid). They were quite cool, painless, and freely movable. I prescribed arsenic. In January, 1905, he sent me a time-table which he had kept. This showed that between May and December, 1904, he had fourteen attacks, occurring fortnightly, though not with exact punctuality; for while the great majority fell strictly on the fourteenth day, one occurred on the thirteenth day, two on the seventeenth, and one as late as the eighteenth day. Between September and December the attacks were shorter in duration and separated by longer intervals, and when the patient wrote at the end of January, 1905, none had appeared for six weeks. He had taken arsenic all along, but, as I gathered, not very regularly.

Case 3.—A schoolboy, æt. 16, had effusion into his right knee-joint (on the first occasion, after a wrench at football) which returned periodically every twelfth day for a period of six months before I saw him in July, 1904. I examined the knee during an attack. As in the other cases, the synovial cavity was distended (loosely), and he complained of resulting discomfort. Movement was unimpaired. The attacks disappeared in three or four days. Arsenic was ordered. His mother wrote in December to say that the attacks had grown shorter and less frequent, and had ceased in November.

These three cases were, in their essential features, very similar. In two of them effusion occurred into one knee-joint, in one case both knees were affected. The effusion returned with notable periodicity—in two every fortnight, in one every twelfth day. I say notable periodicity because, though the recurrence in one case was on one occasion a day earlier, and on three or four others two or three days late, yet, in a total of about fourteen recurrences, only four were delayed by as much as three days, and this when—probably, I think, under the influence of arsenic (p. 22)—the affection was tending to disappear. In all, the local condition—mere increase of synovial fluid—was the same. In all, the joints in the intervals appeared normal—at most the patients complained of slight weakness.

Schlesinger* has called attention to the not infrequent association of acute circumscribed œdema with intermittent hydrarthrosis, and to the close analogy which these affections present in periodicity, and Garrod† to the kinship between certain articular lesions with transient cutaneous erythemata, e.g. the articular pains associated with erythema nodosum and Henoch's purpura and the rheumatic rash in rheumatic fever.

The following case may be related here because it

* Schlesinger, *Mittheil. aus d. Grenzgebietens d. Med. und Chir.*, 1899, xv.

† Garrod, *Quarterly Journ. of Med.*, Jan., 1910.

presented in so marked a degree the phenomenon of periodicity, the attacks recurring every evening at about six o'clock. The affection of the knee, however, consisted not in an effusion into the synovial cavity, but in an acute circumscribed œdema of the subsynovial tissue.

Case 4.—A gentleman, æt. 38, a patient of Dr. Tatham's, of Cheltenham, was kicked on the knee by a horse in December, 1902, but soon recovered. In April, 1903, the knee, for three weeks, was the seat of such severe pain that he could not sleep, but there was no swelling or other objective symptom. A few months later pain became so intense that hypodermic injections of morphia were used. The joint, however, remained cool, movable, and very little swollen. A splint was applied, and he went about on crutches. He had some hot-air baths, but the pain became still worse, and the joint was swollen and measured two inches more than the other. The swelling, however, soon subsided, and when I first saw him, early in December, 1903, the joint, on inspection, appeared natural. There was no swelling, and passive movements were perfectly free and smooth. But the muscles were very much wasted, and so powerless that he could not raise his heel from the surface of the bed, and he carried a hooked stick with which he lifted the foot when, while sitting, he wished to alter the position of the limb. He complained of agonising pain from his hip to his ankle, and said it was like being on the rack. I sent him to a surgical home for further observation, and next morning I was told by the night nurse that he had had scarcely any sleep. He complained bitterly of pain, and said that something must be done. He was even ready to submit to immediate amputation. During my visit he stated that the knee became swollen every evening. On seeing him at 6 p.m. I found that the joint had undergone a very remarkable change since the morning. It now measured $1\frac{1}{2}$ inch more than the other, and the swelling was such as I had never before met with. It followed exactly the limits of the synovial membrane, and within this area it was so abrupt and prominent that the joint had a remarkable globular appearance, and the patella was pushed forward in a very striking manner. There was no fluid in the joint, and the swelling seemed due to vascular turgescence of the synovial membrane, which appeared to be half an inch thick. The patient stated that the joint swelled up in this manner every evening, and then gradually returned to its natural size.

Hoaring of this quite definite periodicity, and having myself seen the difference in the joint between the morning and evening, I thought of ague. I found that during a long residence abroad he had suffered from malarial poisoning, and had often taken quinine; he had taken none, however, since the knee had been troubling him. I gave him ten grains of quinine twice a day. Next morning I learnt that his pain was gone, and that he had slept soundly all night and until 10 a.m. He looked like another man; he was fresh and bright, and said it was the first night without pain which he had had for eight months. He continued the quinine. The pain did not return; in four days the attacks of swelling had disappeared, and he recovered muscular power in the limb so rapidly that in three weeks he was able to walk three miles easily, without any bad result. From that date, although the knee for some time remained slightly enlarged, the periodic swellings never returned. But six months later he had what he described as intense burning and shooting pain, worse at night, and extending from the crest of the ilium to the lower part of the leg. About this time a patch of subcutaneous swelling, covered by over-warm and intensely hyperæsthetic skin, appeared just above the internal malleolus, which prevented him from lacing his boot. The swelling, Dr. Tatham found, was much more pronounced and much more painful at night. The pain was relieved by phenacetin. For some time this swelling remained, and was very painful at night, although during the day the patient hunted and even followed the hounds on foot for twelve or fourteen miles across country. The continuous current was tried, but he declared it increased his pain to an unbearable degree. Then quinine was given in ten-grain doses, with the result that the pain was immediately relieved, and the swelling gradually diminished.

Two phenomena present themselves for discussion—the swelling of the knee and of the subcutaneous tissue of the leg; and the severe pain in the limb, with which were associated great muscular wasting, and powerlessness which almost amounted to definite paralysis. The swelling of the knee was periodic, recurring at intervals of twenty-four hours. When, however, the patient, who had previously often had malaria, had taken twenty grains of quinine, the swelling ceased to recur, and it has never returned. The patch of swelling

of the subcutaneous tissue of the leg also appeared to show periodicity, in that it increased at night and was then attended with intense pain, local heat, and extreme hyperæsthesia of the superjacent skin, while during the day it gave the patient so little trouble that he could run across country for twelve or fourteen miles without inconvenience.

While the patient was taking quinine not only was pain relieved, but the subcutaneous swelling itself gradually disappeared. Later on, when the swelling had returned, it again disappeared while the patient was taking quinine.

At first the question arose whether it was possible that these periodic swellings of the knee and the subcutaneous tissue were due to malaria. Were they cases similar to those in which patients suffering from malaria have been attacked with coma?—to such a case, for example, as the following, recorded by Dr. Hilton Fagge :*

“A gentleman awoke about 4 a.m. with chilliness, nausea, and headache. After an hour he became extremely hot, the pain in his head was intense, and he passed from a drowsy condition into one of complete coma, with deep snoring, as if in a severe apoplectic fit. He seemed to derive much benefit from bleeding and other treatment, and in the morning appeared perfectly well. The day but one afterwards the same symptoms returned and were met by the same treatment, but when a third attack came on Graves saw that it was an attack of *tertiana soporosa*, and cut it short by large doses of quinine.”

I found, however, when I consulted Sir Patrick Manson that he knew nothing of any affection of the joints dependent on malaria, and I learnt from Major Ronald Ross that an examination of the patient's blood was entirely negative. Major Ross agreed with Sir Patrick Manson that nothing was known of any joint-affection due to malaria.

* “Principles and Practice of Medicine,” edited by Dr. P. H. Pye-Smith, 1886, i. 343.

The pain which Dr. Tatham's patient suffered was not only periodic but intense and agonising. Severe neuralgia is often a prominent feature in cases of intermittent hydrops. Indeed, some patients have complained of periodic neuralgic pains long before the joint-affection was observed, while Braekett and Cotton remark that "in some cases severe arthralgia seems to be definitely the equivalent of the effusion. In Dentu's case there was at first intermittent knee hydrops, which ceased, and then, later, severe pain and disability (without swelling) attacked the hips and knees at regular intervals. Still later the periodic swelling of the knees reappeared. Benda's patient had periodic pains in various joints at regular monthly intervals for years before the effusion in the joints began its periodic appearance." This alternation of the joint-affection with periodic pains, or the substitution of the latter for the former, is certainly a very striking phenomenon, and one which forcibly illustrates the obscurity of the pathology of this group of cases.

The condition of the muscles of the limb (Case 4) claims a word of notice. The wasting and loss of power were both extreme. Certainly the manner in which power was regained when quinine was given was remarkable. Three weeks after the patient was unable to raise his heel from the surface of the bed, and was lifting his practically paralysed limb with a hooked stick, he was able to walk three miles without difficulty or fatigue. It seems obvious that some condition which had profoundly interfered with innervation had been abruptly removed by the action of quinine.

After I had written the above account, my attention was directed to a paper in the *Transactions* of the Royal Medical and Chirurgical Society (1867), contributed by Charles Moore, a surgeon to the Middlesex Hospital. He records that he met with two cases of

periodic effusion into the knee-joint. Both patients were females, the one aged 43 and the other 21 years. In the first the attacks occurred for eighteen years regularly once a month. They then changed their period to every ninth day, and that with such regularity that the patient could foretell their returns almost "to an hour." As in the generality of instances recorded by other observers, the attack in Moore's cases lasted in all about four days, and in the intervals the condition of the joints was practically normal. In his second case the attacks recurred every twelfth day. Having related these cases as examples of periodicity, Moore goes on to allude to instances in which the same characteristic had been observed in other regions than the joints, and refers to three remarkable cases of periodic sickness recorded by Joseph Adams. In Adams's first case a young man had been for several years troubled with sickness, which occurred once in ten days, lasted several hours, and was of a violent description. In his second case a "married lady of consideration had been for fourteen years troubled with a sickness which returned precisely on the same day of the week. The nausea was so painful that she was under the necessity for the whole day of taking warm water to render vomiting more easy. . . . In the course of the day she frequently swallowed and returned from five to six gallons of water." In his third case a woman "had been eighteen years affected with a weekly periodical sickness attended . . . with a frequent headache not only on the day of her paroxysm but at other uncertain periods." In two of these cases the sickness was cured by the administration of arsenic.

Treatment.—Until something definite is ascertained as to the pathology of these cases, we can only proceed in the matter of treatment on such general lines as seem to be indicated by our knowledge of the effects

of drugs on symptoms, and by such experience as has been derived from cases that have already been observed. There are two drugs which might naturally be expected to be of service—the two most powerful antiperiodics we possess—quinine and arsenic. And this anticipation of their value has been fully justified by experience. True, both have failed. But both have many times succeeded. The effect of quinine in Case 4 (p. 17) was immediate and striking in the highest degree. In some other cases it was successful. Arsenic is the drug which has been most often useful. In my second case, while quinine had no effect, arsenic, though only when it had been continued for several months, seems to have stopped the attacks. I believe that there need be no question of its value in many cases, yet it should be remembered that the affection may disappear spontaneously for long periods, so that an apparently successful drug may have had really no part in the improvement observed. As matters at present stand, the best course will probably be to give quinine as the first step, and, if it fails, to prescribe arsenic, and if improvement is delayed, to continue it, with due caution, for several weeks, or even longer.

It may be briefly said of local treatment that none has seemed to be of any definite service. During the attacks the joints must perforce be kept at rest, as the patient is unable to use them, but rest seems to have no effect in preventing or materially modifying the attacks. The same must be said of elastic compression and of other local methods.

CHAPTER III

ARTHRITIS SECONDARY TO INFLAMMATION OF THE ENDS OF THE LONG BONES. ACUTE ARTHRITIS OF INFANTS

THE ends of the long bones play a considerable part in the production of disease in the joints, for disease which starts in, and originally exclusively concerns, the end of one of the bones, may subsequently extend to, and involve, the articulation which is adjacent to it. In other words, many examples of joint-disease are not primary. The joints become affected in a secondary manner owing to the fact that they are in the immediate vicinity of areas of bone in which disease is apt to originate. This liability exists to some extent at all ages, but it is especially marked during the early period of life. At that period it arises from the manner in which the stature of the skeleton is attained—that is, by the addition of new material at the ends of the diaphyses of the long bones, immediately beneath the epiphysal plates. In this situation the bone consists of a highly vascular structure in which cell-proliferation and development are in rapid progress—a condition in which the power of the tissues to resist disease is much diminished, so that they are, in Virchow's phrase, vulnerable.



Fig. 2.—Inflammation beginning in the diaphysis immediately beneath the epiphysis, and undermining the connection between them.

Here, then (Fig. 2), various forms of inflammation,

such as the tuberculous, syphilitic, and septic, are prone to arise, with the prospect that, as they extend, they will reach and involve the contiguous joint. Tuberculous disease is of frequent occurrence in this situation, in the case, for instance, of the lower end of the femur and the upper end of the tibia. It is not, however, entirely limited to this part of the bone. The tuberculous process may originate in the cancellous tissue of the epiphysis itself. Thus, Fig. 11, p. 68, shows a specimen in which, while the diaphyses of the femur and tibia are comparatively free, the cancellous tissue of both the epiphyses is occupied by tuberculous deposit.

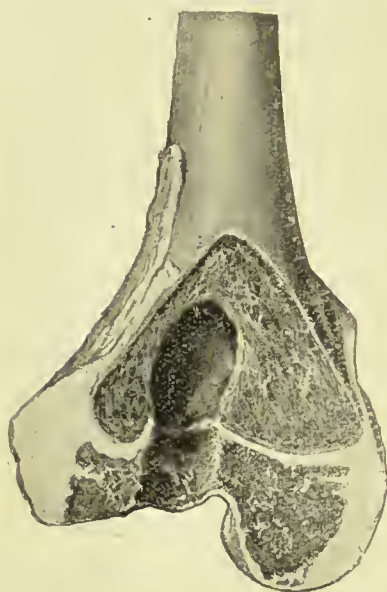


Fig. 3.—Tuberculous abscess bursting into the elbow-joint.

(From a specimen, No. 128, in St. Bartholomew's Hosp. Mus.)

Whichever situation is the starting-point, the danger to the joint is the same. Should the tuberculous process continue to develop, it will break down the structure of the epiphysis, so that it is to a greater or less extent

occupied either by soft caseous material or by a definite tuberculous abscess (Fig. 3). Still extending in the substance of the epiphysis, the disease comes to involve the tissue directly beneath the articular cartilage. The cartilage acts for a time as a barrier; but when it at length gives way the joint itself is reached. If the opening into the joint is large, a large quantity of tuberculous products suddenly escapes into the synovial cavity, producing an acute suppurative arthritis.

Emma B—, aged 5, was admitted into the Children's Hospital with swelling of the lower end of the tibia, of nine months' duration, and a discharging sinus just above the malleolus. The ankle-joint was sound. Next day I found that the child had been awaked during the night by sudden and intense pain in the ankle, which soon became hot, red, and much swollen. Her temperature in eight hours rose from normal to 104° . There could be no doubt what had occurred. Matter burrowing in the epiphysis had burst into the joint. In two days, in spite of free incisions and drainage, the joint was evidently wrecked, and the child was very ill. I therefore performed Syme's amputation. When the joint was opened a sequestrum of the size of a Spanish nut dropped out upon the floor. This sequestrum was found to have escaped from a large cavity in the lower end of the tibia, through a ragged opening in the articular cartilage.

Fig. 4 shows necrosis of the lower end of the tibia, with an abscess bursting into the ankle-joint, and a large sequestrum from the cavity of the lower end of the shaft.

In other cases a mere pin-hole orifice in the cartilage is formed, through which minute portions of tuberculous debris escape, and, inoculating the synovial membrane, produce a subacute or chronic synovitis. In other

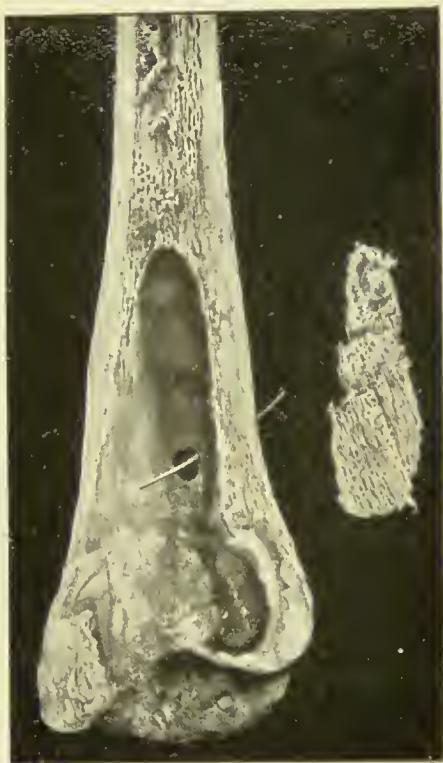


Fig. 4.—Necrosis of the tibia, with an abscess bursting into the ankle-joint.

(From a specimen in St. Bartholomew's Hosp. Mus.)

instances, again, no loose material escapes, but the joint becomes involved by the extension of tuberculous inflammation, from the soft parts around, to the synovial

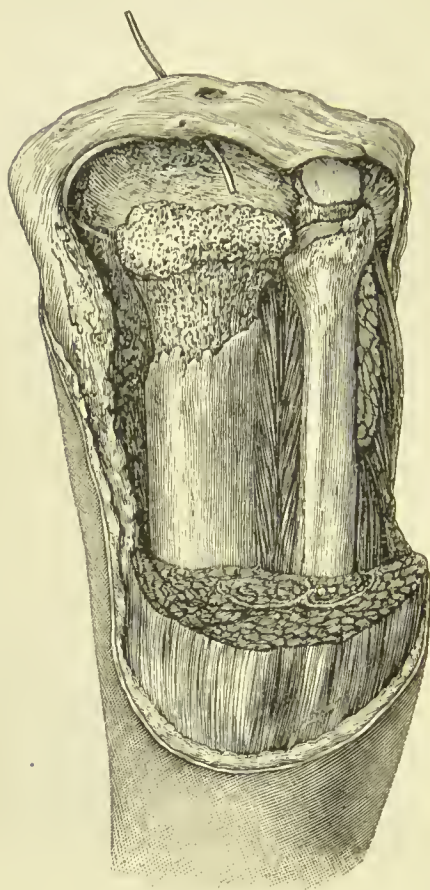


Fig. 5. - Acute osteo-myelitis of the tibia, leading to destruction of the knee-joint.

(From a specimen, No. 621c, in St. Bartholomew's Hosp. Mus.)

membrane. Of these three forms in which the joint may become involved, the last is by far the most commonly met with. The result to the joint will largely depend on the extent of the bone-lesion. When this is limited, and when treatment is adopted early, repair, although it is tedious, will usually follow; but when the bone-disease is considerable the joint is the seat of a persistent irritation, and no sound repair can take place until the mischief in the bone has been successfully dealt with.

In Fig. 5 it is seen that, as the result of acute infective osteomyelitis, the upper part of the shaft of

the tibia has been denuded of its periosteum and necrosed. The epiphysis has become detached, and pus has made its way into the knee-joint by a perforation through which a bristle is passed:

Acute arthritis of infants.—Under this title

Sir Thomas Smith has described* a group of cases which deserve a separate notice. Although at the time the author was in doubt as to their pathology, there need now be no hesitation in attributing them to an acute streptococcal or staphylococcal infection. All the instances recorded by Sir Thomas occurred in infants under the age of one year, and in many the patients were not more than two months old; but the affection is sometimes met with in children as old as two years. It is characterised by its sudden onset and rapid progress as an acute destructive inflammation, involving the growing tissue of the diaphysis immediately beneath the epiphyseal cartilage, and leading to the formation of an abscess in the articular end of the bone, quickly bursting into and producing disorganisation of the joint (Fig. 6). It is a formidable condition. No less than thirteen of the twenty-one cases described by Sir Thomas ended fatally. The disease may attack either one or several joints. Sir Thomas relates a case in which both knees, an elbow, and an ankle were affected. The knee, hip, and shoulder are the joints most often involved. The first evidence is that the joint becomes flexed and stiff. Very soon pain and swelling supervene, and are followed by the distension of the synovial cavity with pus, which, rapidly increasing in quantity, makes its way out through the capsule and forms a large collection in the soft parts round the joint. Unless the abscess is



Fig. 6. — Inflammation originating in the growing tissue of the diaphysis of the femur, with the formation of an abscess bursting into the hip-joint.

(From a specimen, No. 127iii, in the Museum of the Children's Hospital, Great Ormond Street.)

* *St. Bartholomew's Hosp. Repts.*, x. 189.

at once opened and irrigated, the infant will probably succumb rapidly to septic infection or pyæmia. On post-mortem examination, when the mischief is recent, sometimes a small abscess is found in the end of the bone, communicating with the joint by a mere pin-hole aperture. In other cases the epiphysis is so excavated that only a shell remains, and a large ragged hole in the cartilage leads into the cavity of the joint, which is filled with pus. Sometimes, but rarely, a sequestrum is present. At a later stage the epiphysis is found to have been completely destroyed, and the end of the bone forms a shapeless stump.

Sometimes the acute infective process going on in the joint extends to the opposite bone, so that its articular end also is destroyed. In cases in which recovery from such extensive mischief takes place the limb remains flail-like and useless, and the bones, having entirely lost their articular ends, and often their connecting ligaments as well, move quite freely on each other.

As to the frequency with which the disease attacks the different joints, Sir Thomas has recorded twenty-one cases, and to these I have added, in further illustration, six, making a total of twenty-seven. In twenty of these, one joint only was attacked; while of the remaining seven, in one, four; in three, three; and in three, two were involved, bringing the total number of joints affected up to thirty-nine. Of these the hip was attacked in fourteen cases, the knee in eleven, the shoulder in five, the ankle and elbow in four each, and the wrist in one. The smaller joints, in the neighbourhood of which the growth of the bones is comparatively inactive, are but seldom affected.

An analysis of these cases clearly shows that this affection is one that is fraught with grave peril both to life itself, and to the joint which is attacked. Of the

twenty-seven examples, no fewer than thirteen—that is, about fifty per cent.—ended fatally. This result, however, can scarcely be a matter for surprise when the character of the disease, the age of the patient (generally not more than a few months), and the fact that two or more joints may be affected, are borne in mind. In those instances in which the child escapes with his life it is often found that the joint is entirely disorganised, and that the articular ends of the bones are destroyed by ulceration, so that the shapeless and trunated stumps, embedded in loose scar-tissue, meet each other like the two ends of an ununited fracture. In the elbow this result is not inconsistent with a fairly useful condition of the limb. But in either the hip, the knee, or the ankle, the loss of the joint leads to great and permanent lameness, or may even render the patient unable to bear any weight upon the limb. Several examples have been seen in which the head of the femur completely disappeared, and in which the upper end of the bone, formed by the shaft and great trochanter, remained so loosely connected with the pelvis that it could be made to travel freely in any direction, either upwards, nearly to the level of the crest of the ilium, or backwards and downwards to the tuberosity of the ischium, or towards the surface so that it protruded immediately beneath the skin. This change in the situation of the bone was, of course, attended with a corresponding variation in the length of the limb. The femur could be drawn down or pushed up, through a range of at least two inches. When these patients, as they grew older, tried to walk, it was found that, when the weight was thrown on the affected limb, the pelvis sank down upon the femur till the elongated bond of union between the two became tense; but this did not happen till the great trochanter was nearly on a level with the iliac crest. In these circumstances progression

was very unsteady and laboured, and very similar to that observed in the worst cases of congenital dislocation of the hip. Indeed, these two conditions are very apt to be mistaken for each other. (*See Chapter XXXI.*)

In one case, seen fifteen months after the knee had been affected, the stump-like ends of the femur and tibia could be moved freely on each other, and were found to give way whenever the child, who was then twenty-two months old, bore any weight on the limb. In another instance the upper end of the tibia had slipped backwards into the popliteal space, and was overhung by the projecting lower end of the femur, and in this position the two bones were united by cicatricial tissue. In yet another case the ankle-joint had been so completely destroyed that the ends of the bones of the leg fitted into a deep socket in the tarsus.

It may be useful to draw attention to the fact that in instances in which pus has escaped from the joint and formed a large collection deep in the muscular interspaces of the limb, where fluctuation may, to a superficial examination, be indistinct, and large veins are conspicuous on the surface, and the patient has become wasted, sallow, and feeble, this affection is not unlikely to be mistaken for malignant disease. Several cases have been sent up to the Children's Hospital illustrating this difficulty of diagnosis; and in one instance a surgeon was so firmly persuaded that an infant under his care was suffering from sarcoma of the muscles of the thigh in the adductor region that he declined to allow me to open the abscess, or even to explore the swelling. The result was that the abscess increased still further in size, and at length burst; but the child sank from exhaustion.

In some cases, not only is the epiphysis in great part destroyed, but necrosis of the diaphysis may occur.

For treatment, *see* p. 36.

A description of *syphilitic disease* of the ends of the bones will be found in Chapter V.

Chronic adjacent osteitis often lays the foundation of very intractable joint-disease, especially in the knee. Cases are met with in which children of eight or ten, or even young adults, are found to be suffering from joint-disease which originated in tuberculous disease of one of the neighbouring bones when the patient was only two or three years old, and which, though there have been periods of remission, or even of apparent recovery, has several times relapsed. In these cases the joint gradually becomes stiff, and often deformed, and liable, on increase of exertion or disturbance of health, to a renewal of synovitis which may end in suppuration. In these cases the bone concerned must be fully examined, and any sequestrum removed or granulation-tissue cleared away. If suppuration has occurred in the joint, the synovial cavity must be washed out, and drained for twenty-four hours, the whole proceeding being conducted on strictly aseptic lines.

In two of his best-known papers, the one entitled "Necrosis of Joints" and the other "Chronic Abscess in the Extremity of the Tibia," Sir Benjamin Brodie has left clear evidence that he was familiar, from a clinical point of view, with the forms of disease just described. His cases of "necrosis of joints" were examples of disease beginning in the diaphysis, beneath the epiphyseal line, and thence extending into the articular cavity; while his cases of "chronic abscess of the tibia" were, for the most part, instances of tuberculous disease in the same situation, with the formation of pus, following caseation in the cancellous tissue. Thus, as an example of mischief extending from the bone into the joint, his case of J. G——, a boy aged 9, admitted into St. George's Hospital in 1814, may be quoted. One knee was much enlarged, painful, and tender

when handled, and the leg was partially bent on the thigh. It was said that the patient had met with an injury seven years before, and that from that time the joint had not seemed to be in quite a sound state. He had not suffered much from it till within the last four or five weeks, when the knee suddenly became swollen and painful, and confined him to bed. As suppuration occurred round the joint, amputation was performed. "In making a section of the femur through the condyles, an abscess was found in the middle of the bone, in which lay a piece of dead bone of the size of a walnut. The sinus extended from this cavity downwards into that of the knee-joint, communicating with the latter by an opening in the space between the two condyles." No clearer description of chronic tuberculous disease leading to abscess in the articular end of a long bone could be cited than that given by Brodie in relating the case in which he first recognised "chronic abscess in the extremity of the tibia." Mr. P——, æt. 24, consulted him in 1824. There was considerable enlargement of the lower end of the right tibia, extending two or three inches from the ankle-joint. The integuments at this part were so dense that they adhered closely to the bone. The pain was constant, but at times there were such severe exacerbations that the patient's sufferings were described as very great. They confined him to his room for several days, and were attended with considerable constitutional disturbance. The disease had existed twelve years, and had rendered the patient's life miserable. Amputation was performed. The patient unfortunately died in five days, evidently of acute septicæmia. On making a section of the lower end of the tibia, Brodie found the bone greatly thickened, and unnaturally hard and compact. In its centre, about one-third of an inch above the ankle, there was a cavity of the size of a walnut, filled with

dark-coloured pus. The bone immediately surrounding this cavity was distinguished from that in the neighbourhood by being of a whiter colour and of very hard texture ; and the inner surface of the cavity presented an appearance of great vascularity. The ankle-joint was free from disease.

Symptoms.—The symptoms of *disease in the articular end of a long bone*, if it is at all active, are usually characteristic when carefully investigated. The bone becomes painful, and tender on pressure, often over some particular spot. The soft parts covering it are swollen, and the skin may be suffused with a faint blush, but it frequently presents a normal appearance. There is often increased heat of the surface. The patient cannot use the limb, and the joint is maintained in a position of slight flexion. Swelling generally is limited to the neighbourhood of the affected bone, but sometimes, even from the first, the joint is puffy and enlarged. The temperature is raised to 100° or 101° . The disease continues to advance, and it soon becomes clear that suppuration has occurred. The resulting abscess may present beneath the skin, or, by burrowing beneath the periosteum, give rise to swelling, œdema, and fluctuation extending in the limb for some distance away from the joint. Should pus burst into the articular cavity, evidence of acute arthritis will supervene at once.

The symptoms attending *subacute and chronic disease* are often in the early stages of the affection so obscure that they are apt to be overlooked. When the mischief is seated in the mid-substance of the bone, and is advancing slowly, the only symptoms will be severe pain, especially when the limb is being used, slight heat on the surface, and a disinclination on the part of the patient to move the joint. When the affection is more advanced, there is swelling about the articular end of the bone, with acute tenderness on

pressure and pain on movement, and an habitually fixed condition of the joint. Swelling increases, and at length fluctuation can be detected. Should the abscess be allowed to discharge itself spontaneously, a sinus will remain, through which pus continues to escape (Fig. 7).



Fig. 7.—Chronic abscess in the lower end of the tibia, showing a well-marked lining membrane and a small sinus.

(From a specimen, No. 132, in St. Bartholomew's Hosp. Mus.)

Accompanying these symptoms, swelling of the synovial membrane, with pain, and sometimes heat of the surface, may be detected as evidence that the joint is involved. A probe is found to pass through the substance of the epiphysis into the immediate neighbourhood of the joint, and will often disclose the fact that a great part of the articular end of the bone has been hollowed out into a cavity containing fragments of carious bone.

In some cases, a small tuberculous abscess, formed beneath the articular cartilage, in connection with disease of such limited extent that its presence has never been suspected, may burst into the joint. In such instances the real origin of the acute arthritis which follows is very likely to escape detection.

Treatment.—In *acute inflammation of the articular end of a bone*, the imminent danger in which the joint is placed is the main fact to bear in mind, and steps must be taken without delay to provide for the safety of the articulation. A radiogram should at once be taken, to obtain, if possible, positive evidence of the situation and extent of the disease in the bone. The limb must be placed at rest by the use of an efficient

splint, and the patient should be kept in bed. This treatment is absolutely necessary in the case of the lower extremity, and a wise precaution in the case of the upper. The part should be covered either with lead and opium lotion, or with a hot fomentation. Should the patient's temperature remain raised, or should any part of the end of the bone be tender on pressure, or should there be circumscribed redness of the surface, especially if this is combined with œdema, so that there is pitting on pressure, an exploratory incision should be made. It is of paramount importance that pus should be let out as soon as it has formed. The removal of half a drachm, and subsequent drainage, may save the joint and avert an injury to the epiphysis that would be followed by arrested growth of the limb. Should pus be found travelling beneath the periosteum of the shaft, it must be let out immediately. When pus has burst into the joint it must immediately be let out by lateral incisions, the synovial cavity must be freely irrigated with perchloride of mercury lotion (1 in 4,000), drainage must be secured, and the wounds must be treated aseptically. In cases in which not only has the joint become acutely inflamed, but the epiphysis is found to be separated, or the shaft of the bone is found to be involved, the question of amputation must be considered. Should the temperature not be above 102° , and if the patient is not rapidly losing flesh and strength, the operation may be deferred; for when free drainage has been secured the separated epiphysis may unite, and repair that was at first despaired of may, and frequently does, take place. A great danger in these cases is that a general septic infection may be developed. The best chance of this complication being avoided lies in the early and free evacuation of pus, the use of irrigation and drainage and antiseptic dressings.

In *acute arthritis of infants* the same rules must be followed. The joint must be kept at rest, and pus in the end of the bone, as soon as it is detected, must be let out. If it has entered, or formed in the joint, it must be at once evacuated. Undoubtedly the early removal of pus, which, if allowed to remain, would lead to the destruction of the epiphysis and also of the joint, is often followed by an immediate arrest of the inflammatory process and the ultimate recovery of completely free, or of scarcely impaired, movement of the limb. I have seen this result occur even when the knee-joint, for instance, has contained as much as two ounces of pus. If it is found that the ligaments are destroyed, so that the articulation admits of abnormally free movement, care must be taken, should the patient survive, to prevent deformity. For general treatment, all that can usually be done in these young children is to see that they are amply supplied with milk, and with small quantities of well-prepared beef-tea, or raw-meat juice, and with 2 to 3 drachms of brandy in the twenty-four hours, to be given in doses of 10 to 15 minims; while sometimes a few minims of liquor cinchonæ may be given every six hours; when there is much pain a measured half-minim or minim of tincture of opium should be prescribed. Cultures should be made of the infecting organism, and a vaccine prepared and used as soon as possible.

In *subacute and chronic bone-disease* threatening a joint, prolonged rest with fixation of the joint is required. The part must be kept in splints just as it would be if the joint itself were the primary seat of disease. If this rule is adequately carried out, though the affection may extend over several months, recovery will be the usual result, and often suppuration will be avoided. Should pus form, it must be evacuated without delay. In any case in which it has already formed, and has dis-

charged itself through a sinus that has remained un-
closed, exploration should be undertaken for the purpose
of ascertaining whether a sequestrum is present. If a
sequestrum exists it must be removed, together with all
granulation-tissue; and care must at the same time be
taken that a free exit to the surface is provided. To
secure this a sufficient amount of the superficial wall
of the bone must be cut away. The interior of the
cavity, however, should not be roughly gouged. This
may lead at the time to perforation of the joint, or be
followed by an accession of inflammation, in the course
of which the articulation may become involved.

When disease attacks that end of the bone at which
elongation of the shaft is mainly accomplished (e.g. the
upper end of the humerus or the lower end of the femur),
subsequent growth may be considerably interfered
with. A young woman, aged 20, was lately seen, who
had suffered from acute arthritis of her shoulder-joint
when she was an infant, and whose arm was now five
inches shorter than its fellow. In other instances, not
only is growth arrested, but the joint is useless. In a
girl, aged 9, who had acute arthritis of the left ankle
when she was four months old, the left leg was three
inches shorter than the right, and the joint was so flail-
like that the tibia came to the ground when she tried
to walk. As the limb was thus useless, amputation was
performed, and an artificial foot supplied. On dissec-
tion the malleoli were found to have disappeared, and
the truncated lower end of the tibia fitted into a large
cup-shaped hollow formed in the tarsal bones, which
had to a great extent been destroyed. In another case
the head and neck of the femur, and apparently also
the acetabulum, had disappeared, and the stump-like
upper end of the femur slipped about loosely on the
dorsum ilii, as it may be observed to do in some cases of
congenital dislocation. (*See Chapter XXXI.*) In a girl,

aged 4, the leg was an inch and a half shorter than its fellow in consequence of acute arthritis in infancy affecting the upper end of the tibia.

But, instead of producing atrophy and shortening, inflammation in the neighbourhood of the growing end of a bone may, if slight in degree and continued over a considerable period, lead to increased length of the limb as the result of a persistent and abnormally free blood-supply. A boy, aged 9, had had disease of the knee and enlargement of the lower end of the femur for three years. The limb was very nearly an inch longer than its fellow. In another instance of chronic synovitis of the knee-joint, with increased vascularity of the ends of the bones, the limb was an inch and a half longer than the opposite one. A girl of 11 was lately seen whose left radius was three-quarters of an inch longer than the right, and whose hand was pushed over to the ulnar side, as the result of chronic tuberculous disease of the lower end of the shaft in the neighbourhood of the epiphyseal plate. Such results are not uncommon. The condition should be kept in mind, for it is occasionally the explanation of lameness or an awkward gait, the cause of which is not at first apparent.

Chronic abscess in the articular end of a bone.

—This condition is most common in the lower end of the tibia (*see* Fig. 7), but it has been met with in the upper end of this bone, in the lower end of the femur, in the upper and the lower ends of the humerus, and occasionally elsewhere. When the abscess is small, and buried in the mid-substance of the bone, the only symptom, generally, is constant pain, attended with exacerbations, usually occurring at night, and increased by previous exercise. Sometimes the bone is slightly enlarged. When pus is near the surface there is usually some spot to which pain is especially referred; this is tender to the touch, and sometimes so sensitive

that the patient cannot bear even the slightest pressure over it. The tender spot is very characteristic. In some instances a soft spot may be detected. In this situation there is often some slight surrounding swelling of the soft parts. The symptoms, though each, when viewed alone, may seem very slight, are yet, when taken together, sufficient to establish a strong probability that a chronic abscess is present. Especially is this the case when they persist in spite of treatment calculated to relieve neuralgia, rheumatism, or syphilitic osteitis (conditions which this affection most resembles). Diagnosis should be confirmed when possible by means of an X-ray picture.

Treatment of chronic abscess of bone.—The bone should be explored with a narrow chisel applied over the tender spot, or the soft spot, or wherever there is any trace of swelling or of yielding of the wall of the bone on firm pressure. If an abscess has formed, an X-ray picture will generally disclose its presence and exact position. A fine chisel and a heavy mallet, gently used, are much to be preferred to a trephine—an instrument very difficult to use if the abscess is situated at any depth. When the abscess-cavity is found it should be laid freely open, scraped, and allowed to granulate from the bottom:

CHAPTER IV

TUBERCULOUS ARTHRITIS*

THE discovery by Professor Koch, in 1882, of the *Bacillus tuberculosis* must always rank as a great achievement in pathology. Many had long seen that our conception of the wide group of diseases which passed under the antique names of scrofula and struma was derived entirely from their morbid anatomy and clinical manifestations, and that their true pathology was a mystery. The phenomena observed disclosed a subacute and persistent form of inflammation. This was the result. But behind this inflammatory process there was evidently some hidden cause. It is to Koch that we owe the solution of the problem. We now know that these diseases are bacterial in origin, and that their clinical phenomena depend essentially on the inflammatory process which the *Bacillus tuberculosis* sets up in the infected tissues. Thus the terms scrofula and struma are no longer required, for the whole group of diseases to which they were formerly applied are now ranged under the head of tuberculosis. But, given the tubercle bacillus, another factor for the development of the tuberculous process is required: there must be an appropriate or fitting soil. In what this fitness consists is not at present known, but it means an inability on the part of the tissues to resist the bacillus and prevent its growth and extension. In some individuals this defect is clearly hereditary; in others it is produced

* Tuberculous disease of individual joints is discussed later in chapters dealing with the joints separately.

by impaired general health ; in others, again, by local injury.

Where the inflammatory action originates.

—The tuberculous process does not originate in ligaments or in cartilage, as these structures contain no blood-vessels along which the bacillus can gain an entrance, nor would they afford it sufficient nutriment. It commences either in the synovial membrane, or in the articular ends of the bones. The relative frequency with which these two structures are primarily attacked no doubt varies. The affection commences much more commonly in the articular ends in the young (in whom osseous tissue is undergoing rapid development) than in adults. In the latter, synovitis is the more usual form of onset. In young subjects the disease starts most frequently in the synovial membrane in the wrist, elbow, and ankle ; in the hip, in a large proportion of cases, it begins in the bones (Chapter XXX.) ; in the shoulder and knee it begins in the synovial membrane and the bones in about equal proportions. At first, in synovial cases, only a circumscribed area is involved, and from this primary focus extension occurs till the whole membrane is infected.

When the disease begins in the synovial membrane (*see* frontispiece), this structure becomes swollen and opalescent, and is found on section to be of increased vascularity and loaded with exudation products, while its surface loses its smooth appearance and is gradually changed till it assumes the aspect of granulation-tissue. As the disease advances, the membrane becomes thickened, soft, and friable, and here and there, both in the membrane itself and in the subsynovial tissue, masses of caseous material are present. When once established in the synovial membrane the inflammatory process soon extends to other structures, so that the articular cartilage, the ligaments, and frequently the ends of the bones

also, are involved. The cartilage loses its natural bluish-white tint and polished surface, and assumes a dull



Fig. 8.—Erosion of articular cartilage in tuberculous joint-disease.

(After Billroth.)

yellowish and opaque tint. Wherever its margins are overlapped by vascular synovial processes it undergoes erosion or even complete destruction; or the synovial membrane acquires firm adhesions to its surface, vessels enter its substance, and a number of pits and excavations

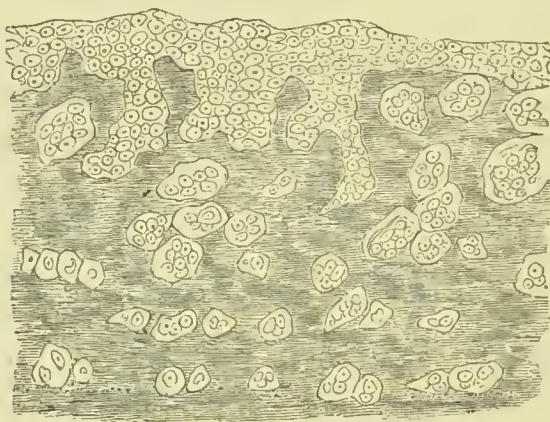


Fig. 9.—Destruction of cartilage in tuberculous disease, extending from the synovial membrane. The surface of the cartilage is covered with granulation-tissue.

(After Billroth.)

are formed containing granulation-tissue (Figs. 8, 9). These pits, continuing to increase both in number and size, coalesce into large hollows and spaces, and by

degrees the bones are entirely denuded; and the ligaments become permeated with newly-formed blood-vessels, and undergo swelling, softening, and partial or complete destruction. The ends of the bones in like manner, as the tuberculous process reaches them, become involved in a rarefying osteitis. Thus, if the mischief is allowed to advance, a general arthritis involving and leading to the disorganisation of all the constituent parts of the joint is produced. In other instances the tuberculous process may originate in the cancellous tissue of the epiphysis itself (*see* Fig. 10).

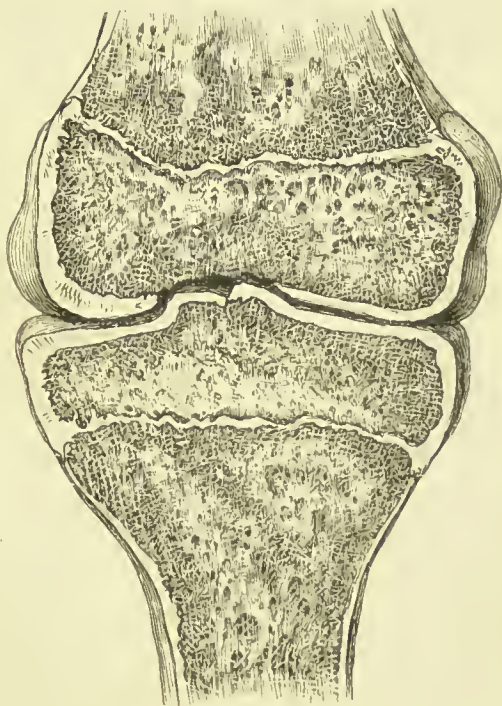


Fig. 10.—Tubercle deposited in the articular ends of the femur and tibia.

(From a specimen, No. 123, in St. Bartholomew's Hosp. Mus.)

In still other instances the inflammatory action originates in a deposit of tubercle in the ends of the bones (Fig. 3), and extends, in the manner described on p. 24, to the synovial membrane, cartilage, and ligaments, and, as before, general arthritis is established.

Clinical aspect.—In its clinical aspect tuberculosis of the joints produces some very important examples of disease. These affections are of frequent occurrence; they involve all the principal articulations;

they are, with few exceptions, the only lesions of the joints, setting aside tumours and the results of injury, which call for such proceedings as amputation and excision; they are attended, in many instances, with severe and prolonged suffering; they may leave the patient crippled for life; they may, if suppuration occurs and septic infection is allowed to take place, even lead to a fatal result. But there is a further ground on which these diseases claim careful attention. The estimate that is often formed of them is derived partly from a still lingering tradition, and partly from what is seen in neglected cases. Such cases, however, convey a highly exaggerated impression of the degree in which these affections are intractable. It must be remembered that a disease of inflammatory origin is very much what it is allowed to become, and the instances referred to reach the destructive stage which they ultimately attain only because they have been left to drift from bad to worse. In their incipient period these affections are, to an extent which some, even at the present day, appear unable to credit, amenable to the influence of appropriate treatment.

Take, for example, a case of tuberculous disease of the hip-joint. In the early stage—that is, in the first two or three months—this affection is merely a subacute, slowly developing inflammation, which is undoubtedly obstinate and prone to relapse, but which, on the other hand, if it receives adequate treatment, will gradually subside, as the tuberculous process dies out, without producing deformity, often without involving loss of movement, and very generally without leading to suppuration; while, should suppuration occur, it may be remedial rather than destructive (p. 433). Now, it is much more important to recognise the fact that these tuberculous affections are curable in their early stage than to dwell

on the destructive changes to which they give rise at a later period. No one at the present day would estimate the gravity of a compound fracture by taking a case in which all the necessary treatment had been withheld. We should turn to an instance in which adequate means had been applied. When we adopt this course in respect to tuberculous diseases of the joints we are led to entertain a very much more favourable opinion than is usually formed regarding them. As obstinate local inflammations, tending to relapse, they call for the application, at the earliest possible moment after they are detected, of two great principles of treatment: first, that of long-continued and perfect rest, which will secure them against the effects both of external injury and of reflex muscular spasm (p. 513); and, second, the prevention of deformity by the aid of some adequate mechanical support. When these two conditions are fulfilled, and when patients are placed in favourable circumstances as to open air and good food, recovery, with complete restoration of the functions of the joint, is, in a large proportion of instances, simply a matter of time.

It would be unreasonable, as well as futile, to deny that this long expenditure of time is a serious element. It is distressing to parents to keep a child at rest in the horizontal position for six, twelve, or, as it may be, eighteen months, as is required for the cure of incipient hip-disease; or to continue the use of splints for a knee- or an elbow-joint for a similar time. All this may at once be allowed; but the fact remains that if the care is taken and the penalty paid a complete cure is generally assured. There are very few parents who, when the choice is laid before them, will hesitate to carry out this treatment, tedious and difficult though it be, in order that their child may escape the suffering and life-long injury and incapacity that must ensue

if the case is allowed to take its course. A mother spent two distressing years in nursing her boy, who had drifted into incurable disease of his hip-joint, and who at length died of lardaceous disease. Six months later it was found that her girl of 5 had incipient hip-disease. Laying her former experience to heart, she carried out the treatment by rest and extension which was recommended to her, with the most critical care and with unwearied assiduity, for eighteen months, with the result that the child made a complete recovery.

The objection to the treatment by long periods of rest which many entertain—namely, that it is prejudicial to the general health—has been greatly exaggerated. There is abundant evidence to show that mere confinement to the horizontal position has, in itself, no seriously prejudicial influence on the patient's health. As a rule, there can be no doubt whatever that children whose health has not been already injured by the presence of local disease will remain, although they are kept at rest, perfectly well, with good colour and good appetite. They will grow rapidly, sleep well, and, possessing as children do a great power of adapting themselves to circumstances, will be contented and cheerful. Often, instead of wasting and growing pale, they gain flesh and colour; especially is this the case when the treatment by rest relieves them of pain in a large joint. I have known many children who, having chronic hip-disease, have been kept in the horizontal position for a year or more, and who have maintained perfect health for the whole period, and have subsequently borne no trace whatever of confinement. At the Alexandra Hospital for Hip-Disease it is easy, by their appearance, to point out which of the patients have been recently admitted and which have been longest in bed; for the former are pale and wasted, as the result of the pain and loss of

appetite and sleep which the disease has entailed, while those who have been in the horizontal position for a twelvemonth, and in whom the disease has subsided, are well nourished and rosy. All this may be said with greater confidence than ever now that the treatment is conducted by the open-air method.

A point of great importance, in respect to these chronic inflammatory affections, is that the tendency to their development is transitory in all but the worst cases. Many children who, when they are between three and eight, develop various tuberculous inflammations, appear, as time goes on, to pass into an entirely different condition of health. They recover from the lesions from which they have been suffering, and subsequently continue perfectly well. This change from liability to immunity may depend either on the acquisition on the part of the tissues of an increased power of resistance, or on the disappearance of those qualities, in whatever they may consist, which constitute fitness of soil. Bearing this clinical fact in mind, it is evident that the course to pursue is to treat these diseases diligently and persistently, so as steadily to oppose their advance, and in the case of the joints to be studiously careful to prevent the occurrence of deformity. For if, in the period during which the tendency to tuberculous inflammations, with the various complications by which they are followed, exists, we are able to avert any results that lead to permanent injury of the joint, we may confidently look forward to the time when the tendency to disease will give place to an equally marked tendency to repair. That this ultimate tendency to repair is the key to treatment, and that we may depend upon it, is shown by numerous cases in which, even though the disease had reached an advanced stage and had led to suppuration, recovery, often unassisted by treatment, has at length taken place. These are the instances in

which a hip-joint is found firmly ankylosed, though, as the numerous cicatrices show, many abscesses had been developed, and though great deformity has resulted; or in which Pott's disease of the spine, after advancing to the stage of extensive angular deformity, has been followed by recovery; or in which, again, all disease has ceased in a knee-joint after, unhappily for the future of the limb, irremediable deformity had been allowed to take place. It must always be a matter of regret that the efficacy of repair in these instances has been so largely discounted by the deformity which has been allowed to supervene, and that, though the patient has recovered from a serious local disease, he remains crippled for life.

Like many other forms of tuberculosis, affections of the joints most frequently occur between the ages of three and nine. A very large proportion of the patients admitted into the Hospital for Sick Children, and the Alexandra Hospital, with hip-disease have been attacked before they were six. The most common period of all is between the ages of three and five. As age increases, the frequency with which these affections make their appearance steadily declines. They may, however, develop at any period of life: middle age is not exempt, and in elderly persons they are by no means rare. (*See under Senile Tuberculosis, p. 66.*)

With regard to the frequency with which the various joints of the extremities are affected, the hip is most often involved, the knee next, then the ankle, elbow, wrist, and shoulder. Young* gives the following analysis of 1,000 cases: Vertebrae, 416; hip, 421; knee, 103; ankle, 33; elbow, 17; wrist, 8; and shoulder, 2. Elmslie,† dealing only with children in the Cripple Schools of the London County Council,

* "Orthopædic Surgery," 1906.

† *Rept. Educ. Com. L.C.C.*, 1907.

analysed 500 cases thus: Spine, 186; hip, 203; knee, 83; other joints, 28.

The impression, which has long been current, that tuberculous disease often follows local injury, such as a blow or a severe jar, is, no doubt, correct. And the explanation is that when tissues have been injured, and especially when they have become the seat of inflammatory exudation, they offer a very favourable soil for the growth of the tubercle bacillus. In the same way, and equally because the power of resistance of the tissues is diminished, tuberculous disease is apt to follow the exanthemata, particularly measles and scarlet fever.

Frequently, however, tuberculous disease is developed in cases in which there has been no previous attack of illness, and in which no local injury has occurred. Thus, to give a clear example, a child may be attacked with disease of one hip-joint when he has been kept at rest for five or six months for disease of the other hip, or of the spine.

Symptoms of tuberculous disease of the joints.—The general conception to be formed of these tuberculous affections of the joints is that they are examples of subacute inflammation, beginning, and in all their earlier periods progressing, so insidiously that they are apt to make considerable advance before they are detected. Their symptoms are so slight, and so wanting in any specific feature, that parents, and sometimes even practitioners, are apt entirely to misunderstand their significance. Slight and intermittent lameness, scarcely interfering with free exercise; occasional pain, ascribed by the mother to rheumatism or “growing pains,” or put aside as a mere fancy; disturbed and uneasy sleep, with twice or three times in the night a faint cry or whimper, thought to be a nightmare—these are often the only symptoms in the

first two or three months of an affection which, unless recognised early and very pertinaciously treated, will tend to develop into so formidable a condition as advanced disease of the hip or of the knee.

Lameness.—Lameness in the lower, or impaired movement in the upper, extremity is an early symptom which must never be left without investigation. Sometimes it is constant and obvious, and the child is seen at a glance to be lame; or it is noticed, in the case of the upper extremity, that the patient uses the limb in a peculiar manner for lifting objects, or for feeding himself, and this on closer observation is found to be due to stiffness or sensitiveness of one of his joints. In other cases this lameness, or impaired movement, is only occasionally seen, when the child is being dressed in the morning, or after a long walk, or after he has been about all day; while at other times movement is natural, and he runs about freely, and without any visible defect. There is nothing whatever that is characteristic of tuberculous disease in this symptom of lameness, and it may be difficult at first sight to determine which joint is affected; but its mere existence must lead to a full search for its cause.

Pain.—The amount of pain, and the period at which it is developed, present wide differences in different cases. In some instances, particularly in the hip, pain is from the first considerable and persistent, is increased by exercise, and leads to night-screaming, a symptom which cannot fail to excite apprehension. In other cases, mothers and domestic nurses are entirely misled by the complete absence of pain. Many a parent, when told that her child has disease of the hip or knee, will dispute the diagnosis on the ground that the child has had no pain. It cannot, however, be too clearly stated that pain is no essential characteristic of either the commencement or the subsequent progress of tuber-

culous disease ; and I have seen children with advanced disease of the hip or the knee walking on the limb without, as the mothers stated, any complaint even of uneasiness. Cases in which it was found that advanced joint-disease was present, although no pain had ever been complained of, are mentioned at p. 74 *et seq.*

Swelling.—In all the joints except the shoulder and the hip, which are so deeply covered with soft parts that, unless it is considerable, it cannot be detected, swelling is a very important symptom, for it is almost invariably present, even in the earliest stage. It may be very slight, and only to be detected after very careful comparison (by inspection and measurement) of the suspected with the corresponding sound joint. In the knee, a slight fullness or puffiness at the sides of the ligamentum patellæ, or, in the elbow, at the back of the joint on either side of the triceps tendon, is often the only distinct evidence that can be obtained that disease is present. On one occasion a boy, aged 5, was brought to the out-patient room because he sometimes walked lame. The hip, knee, and ankle were very carefully examined, but all these joints moved with normal freedom and without pain. To ascertain if the case was one of Pott's disease, or of anterior poliomyelitis with slight loss of power, the boy was placed standing on a chair, in a good light, so that his spine might be examined. It was then clearly seen that there was swelling of the synovial membrane of the ankle on each side of the tendo Achillis, giving the joint the appearance of increased width as seen from behind. On further investigation there was no doubt that the case was one of synovial disease of the ankle-joint.

Defective movement.—Here, again, is a symptom of the greatest value. Impaired movement is, in fact, the symptom which is, on the whole, the most constant and the most trustworthy. Its value in the case of the

different joints is alluded to in the special chapters on their diseases. It is most marked in the shoulder and the hip. In the disease of these joints it is absent only in very exceptional cases. It is least apparent in the wrist and the ankle ; yet even here, when movement is tested at its extreme ranges, some defect will almost invariably be detected. In short, if a joint moves with perfect ease and freedom, it is very nearly safe to conclude that it is not the seat of even incipient disease. This proposition, however, must not be taken as absolute. (*See* p. 429.) Nor must it, in the presence of other symptoms, induce us to omit the further examination of the case after the lapse of a few days. I saw at the Hospital for Sick Children a girl, aged 9, who, her mother said, was occasionally slightly lame. On very careful examination of the limb, nothing amiss could be detected. A fortnight later, however, the hip-joint was completely stiff, and there was appreciable muscular wasting : clearly hip-disease was present. It must also be remembered that if a child who has incipient joint-disease is kept for a few days at complete rest, especially if a weight has been applied to the limb, every trace of stiffness may for the time disappear, and in these circumstances the affection may easily be overlooked. A caution must here be given against the practice, sometimes recommended, of using an anæsthetic during the examination of a timid or fractious child for supposed joint-disease ; for, with the relaxation of the muscles, both the abnormal position of the limb and the limitation of movement at the joint—the two clearest symptoms—will be removed, and a case whose true nature might with a little tact have been correctly ascertained will probably be overlooked.

Muscular wasting.—This symptom is developed in very different degrees in different cases. It is, however, always a very important evidence of disease, and one

that is very rarely, if ever, absent when a tuberculous joint-affection has become established. It may be detected by critical inspection and by comparing the circumferential measurement of the suspected with that of the sound limb at exactly the same level. But further, even though measurement is the same on the two sides, a slight degree of wasting may sometimes be recognised by the flabby condition of the muscles in the neighbourhood of the affected joint. Particular groups of muscles are especially affected in the case of the different joints. In disease of the shoulder-joint the scapular muscles which act on the humerus are involved, the deltoid and the supra- and infraspinatus muscles are wasted; so that the whole shoulder looks flattened and shrunken in comparison with its fellow. When the elbow is affected it is mainly the muscles of the arm that waste; when the wrist, it is chiefly those of the forearm, particularly the extensors and the supinator longus; when the hip, the glutei are wasted, so that the gluteal region is flattened and the gluteal fold lost. But atrophy is also very clearly marked in the muscles of the thigh, and may be detected by measurement of the two limbs at the same level, without an exposure which would be annoying to a female patient. In disease of the knee the quadriceps extensor group is chiefly affected, while in the ankle it is the muscles of the calf that are mainly involved.

It must be borne in mind that this symptom of muscular wasting, like others that have to be considered in the diagnosis of joint-disease, has, taken alone, no diagnostic value. It is a condition met with in many other affections: e.g. wasting of the calf-muscles is found, not only in disease of the ankle, but in infantile paralysis, in flat-foot, in congenital hip-dislocation, etc. The symptom must therefore only be taken as evidence that something is wrong, and must induce the surgeon

to undertake a complete investigation of the case. Wasting is of value in affording some measure of the severity of the joint-affection with which it is associated. When it is considerable and has been rapidly developed it indicates grave disease ; when it is slight, notwithstanding that the joint has been some time affected, it is evidence that the disease has not assumed a severe form. It is usual to ascribe muscular wasting in joint-disease to loss of exercise, or to the use of splints. No doubt wasting is often due to one or both of these causes. But, on the other hand, it is often present when the disease is still quite incipient, while the limb is still in use, and before exercise is restricted either by pain or by stiffness. And it is often met with when no splints have been worn ; and in disease of the hip or knee, when both limbs are alike deprived of exercise by confinement of the patient to bed, the limb in which the disease is seated is much more wasted than its fellow. Moreover, the wasting does not involve the whole limb as it would were it due to disuse, but it affects particular groups of muscles which vary with the joint concerned. Thus, in the hip it is the glutei, in the knee the quadriceps, in the ankle the calf-muscles that are its principal seat. The probable explanation is that wasting is reflex in origin, due to inflammation of the nerves which supply the joint.

Treatment.—In discussing the natural history of tuberculosis, allusion has already been made to the paramount influence of local rest in controlling the advance of the disease, and averting the evils to which it so frequently leads. But some repetition here must be excused while referring to the general question of treatment. Many years of careful study of the treatment of tuberculous disease of the joints have strongly confirmed the opinion that the essential agent is complete and long-continued rest, in combination with

abundance of fresh air and nutritious food. Results have materially improved since the open-air treatment was introduced.

Rest, to be efficient, must be as far as possible absolute, so that the joint is never moved. Obviously, the earlier in the case that rest is secured, the shorter will be the period during which it is required, and the better the ultimate result. The full truth as to the recovery of joints from tuberculous disease has been obscured by the fact that, in the first place, rest is often but very imperfectly maintained, and too soon abandoned; and, secondly, that disease is still allowed in many instances to make considerable progress before the case is seriously taken in hand. Parents do not at first realise its gravity, and surgeons are sometimes perhaps not sufficiently emphatic in the directions which they lay down, nor always very firm believers in the efficacy of this kind of treatment. Moreover, as mentioned above, the very general feeling is that two material drawbacks are attached to this method: first, that the patient's health will suffer from confinement; and, secondly, that, if a joint is kept for any long period in splints, it will become stiff. Neither of these objections is valid. The first has already been referred to (p. 46), and therefore it is only necessary to say that a child who is suffering merely from tuberculous disease of a hip- or knee-joint which has not been allowed to advance beyond the early stage will remain perfectly well, though confined to the horizontal posture for so long a period as six months, or even a year or more, if the surroundings as to fresh air and diet are favourable. Children with advanced and neglected joint-disease are wasted and pale from the pain they have long been suffering, and from the drain involved in chronic supuration. This is equally the case whether they are allowed to be up and limping about as best they can,

or are confined to bed without the necessary means for arresting the local mischief which is telling upon them so seriously. In such cases the result of placing the patient at rest and applying the requisite local treatment is a rapid improvement of both the joint and the general health.

Secondly, as to stiffness. The doctrine that if a joint is kept in a fixed position it will thereby be rendered stiff, I regard as completely erroneous. I am convinced that no joint ever undergoes ankylosis merely because it is kept at rest. On the contrary, to maintain rest is often the only way in which future movement can be secured. Stiffness results from inflammation, and is due either to muscular contraction, produced by reflex irritation, or to the organisation of the products of exudation. To prevent it, therefore, the proper course is to arrest the inflammatory process. When this is done, it will be found, in the great majority of cases, that, as inflammation subsides, movement previously lost is regained, and the old saying is once more illustrated, *Causâ sublatâ, tollitur effectus*. In some instances, however (alluded to at p. 71), the inflammatory process assumes from the first a plastic form. In these cases stiffness will ensue, whether the joint is left to itself or whether splints are applied.

Tuberculin and passive congestion in the treatment of tuberculous joint-disease.—The use of tuberculin in joint-disease is still on its trial. It cannot replace operative treatment when cases have become far advanced, though it may prove a valuable adjunct. How far it may help in cutting short the period of rest in early stages must remain an open question until a more prolonged trial has furnished reliable statistics.

Sir A. E. Wright states that at St. Mary's Hospital a number of tuberculous joints have been treated with tuberculin, the results being controlled by records of

the opsonic index, and that these results have been uniformly favourable. There is some difficulty in estimating the value of tuberculin in cases which run a slow course, because the good ascribed to it may perhaps have been, in some proportion, due to rest and general treatment.

If tuberculin treatment is adopted, it requires an experienced pathologist to undertake it. The dosage, especially in children, needs very careful regulation. Too large a dose, especially if given during a negative phase, may diminish instead of raising the child's resistance, and so do considerable harm.

The value of the opsonic index as a guide to the measure of resistance, though highly extolled by Wright and others, is still *sub judice*. The technique at present in vogue presents so many possibilities of error that only the work of an expert is to be relied on. The time involved in repeated estimations of the opsonic index is very considerable, and it not infrequently happens that the results are at variance with clinical evidence.

Treatment by *passive congestion*, though known to Ambroise Paré, was brought into prominence in this country by the late Mr. H. O. Thomas, of Liverpool, upwards of twenty years ago, and has more recently been revived by Bier on the Continent. Bier's method is to apply a constricting rubber bandage immediately above the joint, and then firmly to bandage the limb from below till the joint is reached. The joint becomes swollen and red, and the local temperature is raised. Bier calls this "hot congestion," as distinct from œdema, "cold congestion," which would result if the rubber bandage were applied so tightly as to constrict the arteries. Passive congestion should not cause or increase pain. It is applied for short intervals at first, and subsequently may be continued for many hours continuously, the limb being elevated and massaged,

after removal of the bandages, to aid the return of the venous blood. Bier claims for this treatment that it relieves pain, increases absorption, aids the formation of fibrous tissue, and destroys the bacilli.

It seems not improbable that if vaccine treatment by tuberculin can benefit cases of tuberculous joint-disease, its efficacy may be increased by combining it with passive congestion. The guiding principle in the vaccine treatment is to provide the blood with protective substances—i.e. opsonins—which will enable the leucocytes to grapple with the bacilli. When the focus of disease is in close touch with the blood-stream, as in the lung, this is easily accomplished. In a joint, where the organisms are situated in a less vascular area, the conditions are not quite so favourable, and it seems not unlikely that by increasing the flow of lymph through the part by passive congestion the opsonins may be more readily brought into contact with the tubercle bacilli.

The benefit which follows the opening of a chronic tuberculous abscess must in a measure be due to the re-establishment of the focus with the blood-stream, and would, if this reasoning is correct, be increased by a combination of tuberculin and passive congestion.

Considerable benefit may result from inoculation with staphylococcal and streptococcal vaccines in sinus cases due to mixed infection. Several cases have been recently reported. In all instances cultivations should be made in order to ascertain what organisms are present, and the appropriate vaccines selected accordingly.

Advanced stages of the disease.—In cases that have been allowed to reach an advanced stage there is still much to be done by prolonged rest, but here two additional elements are introduced. These are the occurrence of deformity and the development of suppuration.

Deformity may be due merely to posture, as when the thigh, in hip-disease, becomes flexed and adducted, or when secondary distortion ensues, in the form of lordosis and apparent shortening (p. 421); or it may depend either on destruction of bone, as when the head of the femur and the upper border of the acetabulum are absorbed, and the trochanter is drawn up on the dorsum ilii, so as to be considerably above Nélaton's line; or on displacement of the ends of the bones forming the joint, as when, in disease of the knee, the head of the tibia travels backwards and outwards towards the popliteal space and the leg is rotated outwards. In the former case the distortion may generally be removed; in the latter, this may be impracticable; but even then the patient may recover with a very serviceable limb. As to the treatment of suppuration, pus must be evacuated at once (*see* p. 452), with, however, this essential proviso, that the most scrupulous care be taken to prevent septic infection. In no department of surgery has the introduction of asepsis effected a more complete change than in the treatment of tuberculous diseases of the joints. The wide destruction which formerly was so common did not, it must be remembered, depend upon the mere tuberculous process itself. It was due to the fact that an entirely different element was introduced—the element, namely, of sepsis. It was by this, and by this alone, that all the graver results were produced. Now that it can be excluded, the dangers of tuberculous joint-affections have, it is not too much to say, been reduced by, at the least, 75 per cent.

When the affection has reached the stage of disorganisation of the joint, or of caries of the articular ends of the bones, attended with suppuration of long standing, rest, the provision of free drainage, the scraping of sinuses, and attention to the general health may

still, if thoroughly carried out, lead to repair; but in many instances it will be found that no improvement is taking place, and that some further measure is called for. In such cases the question of performing excision or arthrectomy must be considered. As the grounds for resorting to either of these operations are fully discussed in Chapters XXI. and XXII., they need not be stated here.

Complications.—The principal complications of tuberculous joint-disease are phthisis, acute general tuberculosis, and lardaceous disease of the internal organs.

Phthisis.—It is worthy of remark that patients suffering from tuberculous disease of the joints are little liable to phthisis. This fact, which may be observed in the case of the other joints, is especially obvious in the instance of hip-disease. At the Alexandra Hospital, where there are always between sixty and seventy children under treatment for hip-disease, and where the subsequent history of the cases is, as far as possible, traced out, phthisis is so rare that sometimes a year passes without the development of more than two or three examples of it.

Acute general tuberculosis.—General tuberculosis, often declaring its onset by an attack of tuberculous meningitis, is much less common than in former years, when the bacillus had so many opportunities of growing vigorously and plentifully in the rich culture-medium of septic pus and granulation-tissue. In some instances it has occurred within three months of the commencement of the local disease; in others, a year, or even two years, after the joint-affection had apparently entirely subsided; and it may occur not only when the local disease is severe and attended with suppuration, but also, though more rarely, when the local disease is slight and no suppuration has taken place.

As *meningitis* is so grave a complication, and as its onset is apt at first to be overlooked, a short description of it may be introduced.

Cases of this affection present considerable variety in their method of onset, in the symptoms developed, and the period over which the illness extends before the fatal termination is reached. The symptoms that usually mark its commencement are (*a*) sickness, occurring not only after food has been taken, but spontaneously, when the stomach is empty, and especially when the child wakes in the morning, or after sleep during the day. This sickness often extends over two or three days before any other symptom is present; after the third or fourth day it usually ceases. (*b*) A slow, irregular, and intermittent pulse, sometimes of not more than 60; (*c*) headache, which may be very severe, with intolerance of light, and restlessness, alternating with, and soon followed by, drowsiness; (*d*) obstinate constipation, and marked retraction of the abdomen; (*e*) squint, and, more rarely, inequality of the pupils; (*f*) moaning, or calling out during sleep. Convulsions may be an early symptom; but this is rare. A very important point is that, in the early stage, and when the difficulty is to distinguish between meningitis and some other intercurrent disease, the temperature, if the case is one of meningitis, will be found to be only very slightly raised. Should the temperature be as high as 102° , the probability is that the sickness, headache, and restlessness from which the child is suffering are not dependent on meningitis. Instances, however, in which the temperature is considerably raised are occasionally met with. In some cases the disease comes on very rapidly, with constant sickness, intense headache, great drowsiness, flushing of the face, and convulsions. In other cases the early symptoms are very deceptive. The child may make no complaint about his head, and his

mental faculties may be entirely undisturbed. In one case, a little girl was joining in a children's service and singing hymns with the other patients within five hours of her death from constant and severe convulsions, due, as post-mortem examination showed, to acute meningitis. In another, the chief symptom, for four days, was such severe and uncontrollable vomiting that the child was believed to be suffering from intestinal obstruction. This patient was perfectly sensible, and presented no symptom in any way pointing to intracranial mischief.

The symptoms that should especially rouse suspicion are headache; sickness unprovoked by food; slow, irregular or intermittent pulse; and drowsiness or restlessness, together with the absence of any marked rise of temperature. It may be useful to mention two cases in which the symptoms of meningitis followed immediately on the administration of chloroform, given when an abscess resulting from hip-disease was to be opened. In one of these the child never became fully conscious, but passed from the sleep produced by the chloroform into a drowsy condition, soon followed by other distinct signs of meningitis. In another, sickness persisted for forty-eight hours, and, having at first been ascribed to chloroform, then proved to be the earliest symptom of the meningeal attack. It seems probable that in both these instances brain-mischief was close at hand before the anæsthetic was administered, and that the symptoms were merely precipitated by the disturbance of the circulation due to its use.

Once declared, meningitis runs a variable course. It may last from a few hours to three weeks, or even longer. In the majority of instances death occurs in from ten to sixteen days. The child becomes more and more drowsy, and is soon completely unconscious; sickness usually subsides after the first two or three

days ; the pulse may still be slow and irregular, or may become more rapid again. Squint, inequality of the pupils, and convulsions come on ; headache may either subside, or continue to be severe. Paralysis, either of an arm or a leg, or of one side (often combined with rigidity), or of the parts supplied by some of the cerebral nerves, as the third or the sixth, may be detected. The face is flushed and dusky, the eyes are half open, the conjunctiva is insensitve, and the pupils are fixed. Death may ensue from convulsions, or the child may linger on in a state of unconsciousness for many days, until at length exhaustion leads to a fatal termination.

For the treatment of tuberculous meningitis, the reader is referred to works on Medicine:

Lardaceous degeneration of the liver, spleen, kidneys, or intestines, happily now but rarely seen, may occur as the result of continued or profuse suppuration. The amount of suppuration, however, required to produce it varies very much in different cases. In some patients it ensues when suppuration has been going on for only two or three months, and when the drain of pus has never been great. In other cases it comes on only when profuse suppuration has existed for two or three years, or even for a still longer period. In the case of a labourer in a remote country district, although for twenty years suppuration had been going on in the lower end of the femur and involved the knee-joint, no lardaceous disease existed: In view of this uncertainty, a careful watch should be kept in all cases of chronic discharge. Lardaceous degeneration is declared by enlargement of the liver and spleen, or of either of these organs, or by the appearance of albumin in the urine. It is attended by gradually increasing pallor, an opaque waxy complexion, and in the later stages by general anasarca. It sometimes gives rise, by involving the intestines, to diarrhoea, which

it is found extremely difficult to check. In the early period of lardaceous disease the urine contains only a small amount of albumin, and preserves its normal specific gravity, showing that the excretion of urea is not interfered with. Gradually, however, with an increase of albumin there is diminution of urea and a fall in the specific gravity to 1012, or even to a lower point. At first, this lardaceous change may, if suppuration can be arrested, be entirely repaired, so that the liver and spleen return to their normal size, and albumin disappears from the urine. The presence of lardaceous disease in its early stage is no bar to operative interference, even although the urine may contain a considerable amount of albumin. Indeed, when, in any case of continued suppuration, lardaceous disease is found to have set in, the possibility of diminishing the quantity of pus by operative interference should be fully considered. The removal of sequestra, the scraping-out of deep sinuses, the provision of more efficient drainage, or, in carefully selected cases, the performance of excision, arthrectomy, or amputation (see Chapters XXI. and XXII.), may be followed by complete recovery. In the later stages, however, when the liver has long been considerably enlarged, when the urine contains from a quarter to a third or more of albumin on coagulation and settlement, and its specific gravity is habitually low, and especially when ascites, or general œdema (first noticeable in the eyelids and serotum), or persistent diarrhœa, is present, any considerable operation is attended with a largely increased risk; and the healing of any wound that is made will be very tedious. Still, even in these very unfavourable instances, the removal of a sequestrum, or the provision of free drainage, may be followed by considerable improvement.

Adult tuberculosis.—The foregoing description of

tuberculosis refers to the disease as it occurs in the young. It must, however, be remembered that tuberculous joint-disease, though less common than in childhood, is not rare in persons of middle age, and even in advanced life (p. 66). The following case may be cited: A patient, aged 55, complained of pain in her hip and knee, and of difficulty in straightening the limb. She was believed to have rheumatism, for which medicines were prescribed. Her pain soon became so severe that she could not lie in bed, but passed her nights in a chair. Two months later, when first seen, she was in great pain, especially on the slightest movement of the hip, and she suffered with severe startings of the limb. On examination, the joint was found to be flexed nearly to a right angle, and fixed; the muscles were wasted, and an abscess had formed under the tensor fasciæ femoris. The abscess was opened aseptically, but suppuration became free; and the evening temperature was 102° to 103° . She quickly lost flesh, had repeated attacks of hæmoptysis, and four months later died of phthisis and exhaustion.

The **prognosis** in tuberculous disease of the joints in patients over thirty is very unfavourable. Suppuration is likely to occur, and the disease shows an obstinate tendency to advance. In two cases of hip-disease the patients, a man of 48 and a woman of 56, died of exhaustion, following profuse suppuration; in a third the acetabulum was perforated, and a large abscess burst into the rectum. In three cases of disease of the knee suppuration occurred, and amputation had to be performed. Indeed, recovery, when either the hip or the knee is attacked in patients between thirty and sixty-five, very rarely takes place.

Many of the cases, especially those involving the knee, have illustrated a point of great clinical importance, namely, that in its early stage tuberculous joint-

disease so closely resembles osteo-arthritis that the differential diagnosis is very difficult; in fact, in the first few weeks it may be impossible. The disease commences with slight pain, stiffness, and synovial swelling, limited effusion, and creaking of the synovial fringes on movement (p. 389). There may be very slight surface heat. The disease at first advances slowly, and there is little tendency to flexion. The degree of muscular wasting corresponds with that usually present in osteo-arthritis. In some instances the presence of tuberculous disease of the lungs, or a history of hæmoptysis, has indicated the probable nature of the joint-affection. In others this has been disclosed by increasing thickening of the synovial membrane, and the occurrence of night startings, rise of temperature, and loss of general health. Usually doubt is soon removed by the onset of suppuration.

Senile tuberculosis of the joints.—The late Sir James Paget, in his “Clinical Lectures and Essays,”* has a chapter on Senile Scrofula, in which he expresses his belief that the old (that is, people over sixty) are more often scrofulous than those between thirty and fifty, and certainly are more often so than they are generally supposed to be. “The evidences of scrofula in the old are not only in certain diseases of internal organs to which a scrofulous origin may be probably assigned, but in the diseases of the lymph-glands, bones, joints, the spine, the testicles, and other structures which appear to be the ‘seats of election’ of scrofula in the young. There is not one of these structures in which, within the last few years, instances of scrofulous disease in people more than sixty years old have not been met with. The cases appear equally frequent in private and hospital practice, and no period of life is too far advanced for them. Some of the most marked have been in

* 2nd ed., p. 344.

patients over seventy-five; one of them was in a patient ninety-one years old."

¶ In the following account, in accordance with present pathological knowledge, the name senile tuberculosis will be substituted for that of senile scrofula. This affection of the joints is still apt. to be overlooked and (at least in its early stage, when treatment is so important) to be mistaken for some much less serious condition, such as slight rheumatism or osteo-arthritis. I shall, therefore, offer some illustrations of the disease, and relate my experience of the cases that have come under my notice. But the reader should not fail to consult Paget's original paper on the subject.

Case 1.—In the museum of the College of Surgeons is a specimen* thus described in the catalogue:—"A hip-joint in which, after the head and upper part of the neck of the femur had been destroyed by ulceration, the shaft was drawn up, so that the remains of the neck rest upon the ilium just above the brim of the acetabulum. The capsular ligament has been removed; the acetabulum is filled with fibrous tissue. The walls of the femur are very thin and light. From a woman of 70. Ten years before her death she had an apparently tuberculous affection of her hip. Abscesses, communicating with the joint, opened in the groin, and ultimately the limb became much everted and shortened. The parts, however, ultimately healed. The patient died of apoplexy. After death her lungs and liver were found tuberculous."

Short as this description is, it presents us with all the features of an ordinary case of tuberculous hip-disease in a child of five or six, and the preparation is similar in all respects to many specimens of hip-disease in young subjects.

Case 2.—Some years ago a patient came to the out-patients' room at St. Bartholomew's Hospital for advice about her wrist. She was 62. Nine months before, she had sprained the joint while she was wringing a wet cloth. This injury, though she thought very little of it at the time, was followed by stiffness

* "Path. Cat.," No. 1992.

and swelling of the wrist, and by a sense of fullness and uneasiness, especially at night. Within two months of the accident, swelling was very considerable, and she could not use her hand, and soon the wrist "dropped," so that she was obliged to support it with the other hand. A fortnight later an abscess formed

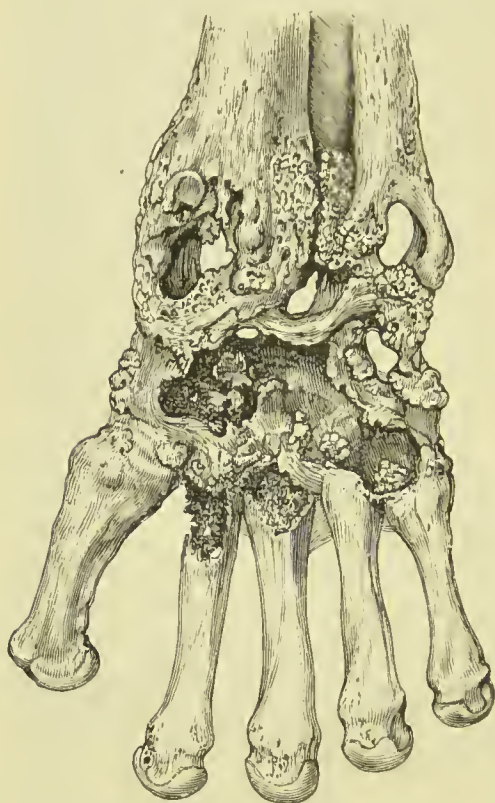


Fig. 11.—Tuberculous disease of the wrist-joint in a man aged 65.

(From a specimen, No. 136, in St. Bartholomew's Hosp. Mus.)

The limb was subsequently amputated. On dissection, it was found that the synovial membrane was pulpy and extensively ulcerated, the ligaments were destroyed, and many of the carpal bones were necrosed and quite loose.

Fig. 11 shows extensive tuberculous disease of the wrist-joint in a man of 65. The disease had been in progress for many months.

Case 3.—A lady, aged 72 years, a patient of Dr. W. H. Neale,

beneath the extensor tendons, and soon burst. The process of suppuration continued, and the joint gradually became disorganised. The wrist presented exactly the appearance met with in advanced tuberculous disease of the joint in a young subject. The wrist was enlarged; there were three sinuses bounded by protruding granulations and discharging thin flaky pus. A probe introduced entered the carpal joints in several directions, and everywhere came into contact with carious bone. The joint allowed abnormally free lateral movement.

developed what was evidently tuberculous disease of her left ankle. The joint became the seat of a slowly increasing fusiform swelling, involving it in all its aspects. The patient was unable to bear any weight upon the foot, and the muscles of the calf underwent marked atrophy. In the course of three months suppuration occurred, and, in spite of free incision, scraping, and drainage, pus burrowed among the tendon-sheaths of the deep muscles. Amputation was performed at the junction of the middle with the lowermost third of the leg. The stump healed favourably, although slowly. A year afterwards the lower third of the left ulna became the seat of extensive tuberculous periostitis, attended with dusky redness and œdema of the skin and considerable pain. A free incision was made and the granulation-tissue was scraped away. The wound slowly healed, and the patient remained well for three years.

At the end of that time her right ankle became involved in considerable swelling, which seemed obviously to depend upon tuberculous synovitis. Within two months the joint had become disorganised, and the ligaments had been so far destroyed that free lateral movement was easily produced. Suppuration occurred; and as the tissues in the lowermost third of the leg were becoming œdematous, amputation was performed six inches above the joint. On dissection the joint was found to have undergone extensive tuberculous disease: the synovial membrane was converted into a thick layer of pulpy granulation-tissue; the articular cartilage was almost destroyed, the bones in places were somewhat deeply eroded, and the principal ligaments had in great part disappeared. Microscopic examination showed that beyond question the disease was tuberculous in character.

Having remained well in the interval, the patient two years later, and when she was 78, complained of pain in the right knee. The joint soon grew hot and considerably swollen. In spite of all that could be done it became disorganised, and amputation had to be performed. The patient made a good recovery.

A main feature of this group of cases is their tendency to go on from bad to worse. This is due, in part, to the fact that their real nature is often at first overlooked, so that the necessary treatment is not brought to bear sufficiently early; but, even when the disease is recognised while it is still incipient, and all that is possible is done to arrest its progress, it still, in many instances,

continues to advance, or, at the best, admits of only very slow recovery. Several instances could be mentioned in which the affection has, in so short a period as three months, gone on to suppuration and the complete disorganisation of the joint.

Treatment consists in at once placing the joint at absolute rest, in well-fitted splints (*see* under Shoulder, Elbow, Wrist, etc.), in prescribing residence in a dry and bracing climate, in giving small doses of quinine, and in ordering an easily digested and nutritious diet. If suppuration occurs the pus must be evacuated, every care being taken to prevent septic changes. Should these means fail to arrest the disease, and the patient's general health become impaired, amputation, if there is no visceral disease, and if the strength will admit, must be performed, except in the case of the hip-joint, where the operation could, of course, not be ventured upon. The patient should be kept in bed as short a time as possible. The ready repair of injuries and wounds in the old, to which the late Sir George Humphry has drawn attention, was illustrated in a case in which I amputated through the forearm for tuberculous disease of the wrist in a woman of 68. The wound healed by primary union, and all dressings were dispensed with after the seventh day.

Quiet tuberculous disease of joints.—It is well known that tuberculous diseases of the joints in the young are often developed so slowly and insidiously, and are in their early stage so devoid of pain or any characteristic symptoms, that they are apt to be overlooked or mistaken by parents for slight rheumatism, or growing pains, or even for a trick. The obscurity in which the early symptoms are involved is so deceptive that it may be worth while to relate some illustrative cases, in order to show that these diseases may reach even an advanced stage without raising, in

the minds of parents and relatives, any suspicion of their presence.* The late Sir James Paget† has described what he terms "quiet necrosis," in which "all the essential facts of the process of necrosis, the death of the bone and its exfoliation, and the formation of new bone, may take place without any attendant phenomena either of inflammation or fever." The cases of joint-disease about to be related closely resemble those of quiet necrosis of bone, in the absence of the symptoms which usually accompany inflammation. There is no pain, no tenderness, and but very slight swelling. There are only slowly increasing stiffness and muscular wasting, symptoms which parents wholly misunderstand, or perhaps entirely overlook.

Case 1.—A girl, 9 years old, who had been kept for six months at complete rest, for the treatment of Pott's disease in the dorsal region with co-existing hip-disease, complained that she could not move her elbow. On examination the joint was found almost absolutely stiff, slightly swollen, and a very little hotter than the opposite joint. The muscles of the upper arm were much wasted. The mother stated that the patient had never complained of pain, but had been noticed for three months to be awkward in feeding herself, and to bend the limb oddly at the wrist; but there was no suspicion that the elbow was diseased and had become stiff. Six months later the joint, which had in the meantime been enclosed in splints, was free from all signs of disease, and looked quite normal, but it was absolutely fixed. For the past four years it has remained thus ankylosed, possibly by bone, but more probably by very close and firm fibrous adhesions. The case appears to have been one of tuberculous inflammation of the synovial membrane, in which the exudation-products, instead of breaking down, as they commonly do in tuberculous inflammation, became organised into cicatricial tissue.

Case 2.—A boy, aged 11, was brought to the Hospital for

* Instances are related (p. 572) in which disease of the spino advanced to the development of well-marked angular curvature, although the patient was unconscious of any symptoms indicating its presence.

† "Clinical Lectures and Essays," 2nd ed., p. 339.

Sick Children, for what his mother thought was some affection of the spine, which had become much arched forward in the lumbar region. On examination, it was seen that the left hip-joint was completely stiff, and flexed at an angle of about 120° , and that there was considerable wasting of the glutei and other muscles of the limb. The curvature of the spine was merely compensatory. Inquiry elicited the fact that the boy had never complained of pain about the hip, and it was difficult to convince his mother that it was this joint, and not the spine, which was the seat of disease.

Case 3.—A man, aged 23, who belonged to a tuberculous family, observed that his right hip and left shoulder were gradually becoming stiff, and that the muscles about these joints were wasting. There was no pain in the shoulder, and very little in the hip. On examination of the joints under ether, it was found that they were firmly fixed. An attempt was made to restore movement in the shoulder by separating the adhesions and employing manipulation; but, though some slight movement was produced, stiffness soon returned, and the treatment was discarded. Both joints have now long been fixed, but they give no pain, and show no other evidence of disease.

Examples of the same kind are not rarely seen in children between four and twelve, in whom the shoulder-joint is found to have become stiff, though none of the other signs of disease have been observed. Attempts have often been made to restore movement in these cases, but never with success. Not having had an opportunity of dissecting a joint thus affected, I feel it difficult to say what are the precise changes that occur; but, judging from clinical observation merely, they consist of plastic inflammation of the synovial membrane, leading to the removal of the articular cartilage, and to either bony or very firm fibrous ankylosis. The shoulder-joint is more commonly involved than either the elbow or the hip. Instances have been seen in which this condition has followed injury of the elbow due to a fall, and in which stiffness has been the only symptom observed. In some of these, the children have been sent to the hospital with the report that they were suffering

from muscular rigidity following injury, and the joint-affection has escaped notice. In the hip all the usual symptoms, except stiffness and wasting, may be so entirely absent that for many months no suspicion of the real state of the case is excited. Even on close inquiry it cannot be ascertained that the child has ever complained of pain, and all that has been observed has been that he has had a peculiarity in his walk. On careful investigation, however, a correct diagnosis may be easily arrived at. Stiffness is always from the first a marked symptom. In the shoulder, when an attempt is made to rotate the head of the humerus in the glenoid cavity, it is found that the scapula moves with the humerus; and the same is noticed when the elbow is moved forwards or backwards, or is drawn away from the chest. The muscles, especially the deltoid, are wasted. In the elbow swelling may be detected, though it is often very slight; there may be distinct rise of temperature of the surface, but this is neither marked nor constant; the joint is more or less stiff, both as to flexion and extension; and supination and pronation are sometimes entirely lost. There is also invariably muscular wasting of the upper arm, and when the case is of long standing this wasting is very marked. In no condition, apart from early joint-disease, can rigidity involving the muscles that act upon a single joint, e.g. the shoulder, come on thus spontaneously, as the phrase is, or follow an injury, and persist while all the other muscles of the limb remain in a normal state. In other words, the explanation of such muscular rigidity is always that the contraction is reflex, and dependent on disease of the joint.

Treatment.—The treatment of these cases must be the same as that of ordinary tuberculous mischief. The parts must be kept at absolute rest, in the manner described elsewhere (*see* under Diseases of the Hip,

Knee, etc.). If this course is not followed and the cases are neglected, the disease will develop into a well-marked example of tuberculous inflammation of the joint. If rest is employed early and is persistently maintained, the joints will in many instances ultimately recover, and regain complete or considerable movement: In some instances, however, the inflammatory action is followed by rapid organisation of adhesions, so that (as already stated) the joint may become permanently ankylosed within three or four months. It is these latter cases which have given rise to the view that if joints are kept at rest they will become fixed. Such instances, however, are, it is highly important to bear in mind, exceptional. Generally, when complete rest is enforced in the treatment of tuberculous joint-disease, it is followed by the subsidence of inflammatory action, the absorption of lymph, the cessation of muscular spasm, and, at length, by the restoration of movement. This restoration is sometimes only partial, but often it is complete.

THE TUBERCULINS*

Various kinds of tubereulin have been used, both as aids to diagnosis and as therapeutie agents.

They have now become limited to Koeh's Old Tubereulin and the New Tubereulin (T.R.). The other varieties in use are modifications of these.

Koeh's Old Tubereulin is a concentrated filtrate of a glycerine broth culture of the baecillus, and is composed of the extracellular toxins of the baecillus.

Koeh's New Tubereulin (T.R.) is a saline extract of the bodies of the baecilli.

The tubereulins may be used as aids to diagnosis by the following methods:—

* For this account I am indebted to Mr. Girling Ball, Demonstrator of Pathology at St. Bartholomew's Hospital.

1. **The cutaneous test, or von Pirquet's reaction.**—Two small areas (about the size of a sixpence) of skin on the anterior aspect of the forearm are denuded of their superficial epithelium sufficiently to expose the superficial blood-vessels and lymphatics. This is done by scraping the skin with a sharp needle, as in performing Jennerian vaccination. The excess of blood is wiped away with a piece of wool. A drop of Koch's Old Tuberculin (full strength) is placed on the one, and glycerine (50 per cent.) on the other, the latter as a control for the former. The areas when dry are protected with gauze. The whole proceeding must be carried out with strict aseptic precautions, as a septic reaction may simulate a positive tuberculin reaction.

The reaction.—On the site of the control inunction, at the end of twenty-four hours there should be nothing seen which cannot be accounted for by the skin abrasion. At the site of the tuberculin inunction an area of inflammation about the size of a shilling should appear. The centre of this area should be raised, bright-red in colour, and in the most severe reactions purple. This condition lasts for about forty-eight hours, and then gradually fades away. This is the positive reaction.

It is specific for the disease.

It is of value in the earliest stages of the disease, but is not reliable in advanced cases. It is especially useful in children.

It is harmless.

It is the best test in cases where pyrexia is present, the subcutaneous test being contra-indicated.

2. **The percutaneous test.**—This consists in the inunction of an ointment containing Koch's Old Tuberculin. It is similar to test No. 1, but the reaction is much more feeble and less reliable.

3. **The conjunctival test (Calmette's reaction).**

—The tuberculin used for this reaction is composed of a 1 per cent. solution of Koch's Old Tuberculin freed from the glycerine by a very complicated process.

The test consists in instilling into the conjunctival sac in the region of the inner canthus the fluid above mentioned.

At the end of twenty-four hours an inflammatory reaction occurs in the conjunctiva resembling the ordinary acute conjunctivitis. This may go on to chemosis. If a negative result is obtained with the first instillation the process should be repeated with strengths of 2 per cent. and 4 per cent., but no stronger solution should be employed.

This test has certain disadvantages. It is always a very uncomfortable process for the patient to submit to. Injury to the cornea has been known to occur. The test cannot be used in cases where there has been any previous eye-lesion.

On the other hand the diagnostic value of the test is considerable, for, although it does not give a positive reaction in all cases, in the large proportion it does.

4. Subcutaneous test.—This is *par excellence* the tuberculin test.

The solution used is Koch's Old Tuberculin. It is given under the skin with an ordinary hypodermic syringe, with all aseptic precautions.

The doses given are $\frac{1}{2}$ mg., 1 mg., 5 mg., and 10 mg. The interval between the inoculations should be four days. The smaller the dose required to give a reaction the better—i.e. if the reaction comes off with the $\frac{1}{2}$ -mg. dose there is no need to give the higher doses. If the reaction does not come off with the 10-mg. dose, then the patient can be considered to be free from tubercle. If higher doses than these are given a reaction will be obtained in a normal adult.

In children, no greater dose than the 5-mg. inoculation should be advised.

The reaction is as follows:—

(1) A rise of the temperature (the most important point in the test).

(2) General malaise.

(3) Increase in the local manifestations—e.g. in a joint, increase in the amount of pain, and swelling, etc.

If pyrexia exists, a reaction-rise cannot be estimated. Its use, therefore, in these circumstances is contra-indicated.

If by other pathological methods positive evidence of tubercle has been obtained, this test should not be used.

~~The last stages of the disease are likely to be accelerated by the inoculations.~~

The method is of very little danger to the patient, although a few cases have been recorded in which the injection has been the means of lighting up a quiescent lesion.

As has been already stated, the subcutaneous test is the best, i.e. as a diagnostic agent, and it should be used whenever such a method of diagnosis is likely to be of value. If, however, pyrexia is present, its place should be taken by the von Pirquet reaction, which is especially valuable in children.

The percutaneous test is of very little value, and the Calmette not devoid of danger.

If a given lesion can be diagnosed without the aid of a tuberculin, then all the methods are contra-indicated.

In the **treatment** of joints the New Tuberculin is used. The dosage varies with different people, and it would be extending the subject too far to give details of the various methods.

The cases which call for treatment are many. The ideal time at which to start giving injections is at

() the very commencement of the disease. Later, surgical interference may be required. After removal of diseased tissues by operation, the injections may be used to prevent recurrence either locally or elsewhere.

(N When an abscess has formed, while the wound remains free from infection by other micro-organisms, the tuberculin can be used by itself, but if a mixed infection has occurred a combined vaccine is indicated.

Tuberculin should be used as soon as the disease has been diagnosed, except in cases where there is marked fever, when it should be withheld until the pyrexial rise does not exceed 100° at most. Little benefit is to be expected when it has been withheld until the case is going downhill after sinus-formation and mixed infection.

Marmorek's antituberculous serum is considered to be of value in the treatment of all varieties of surgical tuberculosis by many Continental observers, and especially in bone- and joint-lesions.

CHAPTER V

SYPHILITIC ARTHRITIS

THERE is good reason to believe that not a few instances of joint-disease which resist treatment by the usual methods of rest, blistering, etc., and which show an obstinate tendency to relapse, are examples of syphilis. It is easy to see how the cases may have been overlooked, for, having been mistaken for subacute rheumatism (which they often closely resemble), and having been treated with iodide of potassium, a drug that enjoys a considerable reputation in rheumatic affections, their disappearance has given rise to no remark. Or they have occurred in association with some other well-marked syphilitic manifestations, and as they have been regarded merely as incidental rheumatism, and have subsided during the treatment prescribed for the lesions that were clearly specific, there has been nothing to excite a suspicion as to their true character. It must also be remembered that post-mortem examinations of the subjects of active syphilitic disease are comparatively rare.

The following account, which agrees in the main with the descriptions given by Lancereaux and Bumstead, and with those of Jonathan Hutchinson, jun.,* is drawn from cases that have occurred in St. Bartholomew's Hospital:

The joints may be attacked during either the secondary or the tertiary stage of acquired syphilis, and also in the inherited form of the disease.

* *Brit. Med. Journ.*, 1892.

Three main varieties of syphilitic arthritis have been met with in adults.

1. During the period of the *earlier secondary skin eruptions*, ulcers on the tonsils, plastic iritis, etc., one or more of the joints may be affected with a subacute or chronic synovitis, attended with moderate effusion, and in all respects resembling rheumatic synovitis of a like grade of severity. No post-mortem examinations, so far as I know, of joints in this condition have yet been recorded; but there is no reason for supposing that any special changes would be found.

Case 1.—Thomas —, æt. 19, was admitted into St. Bartholomew's Hospital, in September, 1885, under my care, suffering from a stiff, swollen, and painful knee-joint. He stated that two years previously he had acquired syphilis, and since that time had frequently suffered from various secondary affections. Three weeks before he came under notice, his right knee became swollen and stiff, and the seat of shooting pains, especially at night. Latterly the symptoms had increased in severity.

Present condition.—A rather emaciated and cachectic-looking lad. He has numerous pigmented sears on his body and legs. On the shins are recent and painful nodes. Both testes are the seat of well-marked syphilitic inflammation; they have been enlarged since January last.

Except for a few months after infection, the patient has had no treatment for syphilis.

The right knee is in an extended position, and cannot be completely flexed. Movement causes slight pain. The joint is a little swollen, though in an irregular fashion. The synovial membrane on each side of the ligamentum patellæ feels thickened and pulpy; that at the upper part of the joint appears to be in a healthy condition. There is no general elastic bulging of the synovial membrane. There is slight excess of synovial fluid. No thickening of the tibia or femur can be detected. The patient was ordered a twelfth of a grain of perchloride of mercury and five grains of potassium iodide three times a day. In a week much of the swelling had disappeared, and in three weeks the joint was quite free from any feature of disease, the nodes on the tibiæ had diminished, and the testes were smaller. He

was so much improved, a few days later, that he was made an out-patient, and shortly afterwards he ceased to attend.

Case 2.—A man, æt. 32, came to the out-patient room for the treatment of secondary eruptions and a sore tongue, six months after he had contracted syphilis. His right elbow-joint was partially stiff. It was painful, and moderately swollen, partly from thickening of the synovial membrane, and partly from fluid estimated to amount to about three drachms. The skin over the joint was very slightly warmer than normal. He was ordered a twelfth of a grain of perchloride of mercury and five grains of potassium iodide. Under this treatment he steadily improved. The skin eruptions disappeared in about three weeks, the ulcers on the tongue healed, and at the same time the elbow became much less painful and swollen. A fortnight later the joint had returned to its natural condition. Six months afterwards he came with a node on the right tibia, a sore tongue, and with the elbow swollen, stiff, and painful, especially at night. Under the same treatment as that first adopted the node disappeared, the sores on the tongue healed, and he lost the pain in the elbow, which became much less swollen. The joint, however, remained somewhat stiff. From this time I lost sight of the patient.

Case 3.—A woman, aged 36, was under treatment with sore throat, cutaneous rash, and two small gummatous swellings in the subcutaneous fat over the biceps in the front of the arm. Her right elbow was swollen and painful, as if the seat of sub-acute rheumatic synovitis. She was pale and emaciated, and had miscarried six weeks previously. Under potassium iodide and cinchona all her symptoms disappeared in a month, and the elbow had returned to its natural size and had recovered free movement. The patient had gained flesh and strength. She then ceased to attend. Three months later she returned. She was again very ill. She had a large subperiosteal node on the middle of the ulna, and the elbow-joint was again stiff, painful, and swollen. Under the use of potassium iodide and quinine she improved, and the node and the joint-affection slowly disappeared. Three months later, however, she was attacked with hæmoptysis, and I afterwards learnt that she died of pulmonary phthisis. Unfortunately, no post-mortem examination was made.

Often during the commencement of the secondary stage there may be pain in and around the joints, which,

like other syphilitic pain, is worse at night. This condition of arthralgia presents no signs beyond a stiffness, which is usually worse after a period of rest, and is relieved by movement and exercise ; it yields readily to treatment.

Late in the secondary stage a condition of hydrarthrosis may arise, either following the more acute synovitis above described, or coming on insidiously without pain, and usually attacking the knee. A typical example has been described by Voisin.

2. In the *later stage of acquired syphilis*, during the period of nodes, rupial ulcers, and gummata, the joints may be attacked with more severe forms of syphilitic inflammation. One or more of the joints may be affected ; the larger articulations, especially the knee, are more often involved than the smaller. The disease, in some instances, begins as a syphilitic infiltration of the deeper layers of the synovial membrane, and extends into the adjacent tissues, in places taking the form of definite gummatous nodules. The endothelial lining of the joint is not itself diseased, but is irregularly bulged towards the cavity of the articulation by the inflammatory products beneath it. In some cases the synovial membrane has the appearance of being half an inch, or even an inch, thick ; and a noticeable feature is its irregular and nodular condition, a feature which distinguishes these cases from tuberculous arthritis. Effusion, always limited in its amount, may be entirely absent. Movement is seldom much restricted, and produces little, if any, pain, even when extensive disease is present. In some instances inflammation and enlargement of the articular ends of the bones are also met with. A characteristic of this gummatous form is its tendency to recur even after apparently complete cure.

I have seen two cases, both in women affected with

tertiary syphilis, in whom, with extensive gummata deposited in the subcutaneous fatty tissue around and below the knee, there was some stiffness of the joint and thickening of the synovial membrane, with considerable effusion into the cavity of the articulation. In one, the gummata had broken down, and led to the formation of a number of large and deep ulcers, running together in the shape of a crescent below the joint. In the other, the patella underwent necrosis, and almost the whole of the bone came away in three or four large fragments. In both, the disease extended over many months and showed a strong tendency to relapse, in spite of full courses of potassium iodide. In these cases the joint-affection was secondary to gummatous disease in the neighbouring soft parts.

In this form of disease, as post-mortem examinations recorded by Lancereaux show, the synovial fluid becomes turbid from the admixture with inflammatory products. The cartilages may become eroded, and the ligaments softened or destroyed.

3. Arthritis, in another group of cases, *begins in the ends of the bones*, and subsequently spreads to the soft tissues of the joint. In these instances the articular extremities of the bones are enlarged, and the patients complain of severe neuralgic pains, especially at night, resembling those experienced in syphilitic osteitis elsewhere. The examination of the knee-joint of a patient who died in St. Bartholomew's Hospital, under the care of Sir W. Savory, showed (Fig. 12) that the periosteal disease, attended with the formation of new bone, was similar to that met with in other situations.

In **hereditary syphilis**, in children and young adults, it is not rare to meet with a joint-affection which very closely resembles tuberculous synovitis of a chronic type. The form taken may be either a simple effusion or a gummatous synovitis. In the cases of simple

effusion the knee is most commonly involved, and the disease is often symmetrical; the effusion is considerable, so that the synovial membrane is distinctly mapped out, the patella rides, and fluctuation is easily obtained in all the axes of the joint. In the case of gummatous synovitis the synovial membrane is much thickened, and,

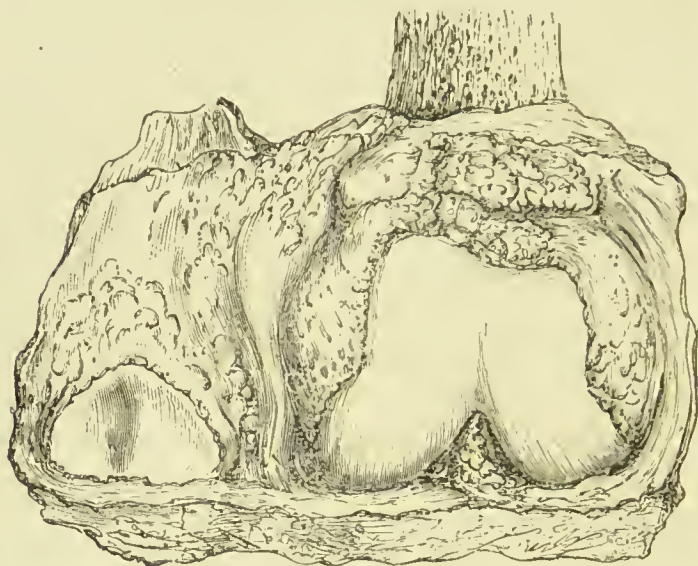


Fig. 12.—Syphilitic disease of the knee-joint. The subsynovial tissue, thickened and tuberosed from gummatous exudation, bulges the synovial membrane itself towards the cavity of the joint. The lower end of the femur is inflamed and roughened.

(From a specimen, No. 567A, in St. Bartholomew's Hosp. Mus.)

in places, irregular indurations and tuberos masses can be felt. The joint remains in an extended position, and there is no tendency to deformity. Movement is but little impaired. The affection is usually quite painless. In one case I aspirated the joint. The fluid removed, four ounces in amount, was merely turbid serum.

In infants, the subjects of congenital syphilis, the articular ends of the long bones are liable to a remarkable form of disease. Osteo-chondritis occurs in the sub-epiphyseal plate of cartilage and adjacent bone. There is a multiplication and irregularity of the cartilage-cells

of the ossifying layer and premature calcification. As a result, the circulation is insufficient, and necrosis of part of the cartilage follows, which, acting as a foreign body, sets up inflammatory changes in the adjoining parts. Thus from the end of the diaphysis a fungating growth, the result of low inflammatory action, takes place, consisting, for the most part, of soft granulation-tissue, which gradually separates the epiphysis from the shaft, so that mobility and dull grating may be detected, as if fracture had occurred, while the limb appears to be paralysed (*syphilitic pseudo-paralysis of Parrot*). Generally no suppuration occurs, and the joints themselves remain free from disease. The tendency of the affection to undergo repair when mercury is prescribed is very marked. X

In the more severe cases, however, suppuration occurs, and, as the result of ulceration, the epiphysis becomes entirely broken down, and pus either bursts into the joint or collects in the soft parts in the neighbourhood of the epiphysis. The ends of the bones, at which growth principally takes place, are the most frequently attacked. The nature of the disease is generally disclosed by the existence of other affections of a syphilitic character:

These syphilitic affections in the neighbourhood of, or involving, the joints are usually met with in infants between the ages of two or three months and two years. They may, however, occur in the first month after birth. They are often multiple. They are characterised by node-like swelling of the epiphysis and adjacent part of the diaphysis of the bone concerned, producing considerable enlargement, and attended with thickening of the surrounding soft parts, and with tenderness and a minor degree of pain.

Fournier* has described a rare condition seen in

* "Syphilis Héréditaire Tardive," 1886.

hereditary syphilis under the name of "arthropathie déformante," in which the epiphyses are enlarged in a very irregular manner by osteophytic outgrowths, resulting in very marked deformity and much limitation of movement.

Bowlby* has published a case in which many of the joints were the seat of remarkable changes, which were probably the result of congenital syphilis.

The patient, a youth of 18, came under the care of Mr. Baker, in St. Bartholomew's Hospital, in 1882, for ulceration of the right leg. He had been in good health till three years before, when he had synovitis of the left knee.

A year later, swellings began to form on his tibiæ. After several months one of these swellings broke down, and ultimately some bone came away. An ulcer was left which was still unhealed. At its base the tibia was thickened. On the right tibia was a hard, nodular swelling. There were no other signs of hereditary syphilis, and the eyes and teeth were normal. Mr. Baker prescribed potassium iodide, and chiselled away the carious bone. The wound healed very slowly. A year later the wound had broken down again, and the right tibia was enlarged, and its surface was exposed in the floor of an ulcer. The condition proved very intractable, but after six months' rest, several gouging operations, and the prolonged use of potassium iodide, healing was secured.

Soon afterwards a sharp attack of synovitis of the left knee and of both elbows brought the patient back to the hospital. The joints contained a good deal of fluid, and were a little painful, but with the application of mercurial ointment and elastic pressure the fluid disappeared, and the boy was discharged in March, 1885. On September 1st he returned, having three weeks before

* *Med.-Chir. Trans.*, 1894, lxxvii. 43.

noticed swellings on the left side of his forehead, and right arm. The swelling on his shin, he said, broke down again shortly after he was last discharged. Examination showed a fluctuating swelling, covered by inflamed skin, on the middle of the right humerus, on its outer side. The shaft of the bone was thickened. Over the left eyebrow was a swelling as large as a walnut, firm, and attached to the subjacent bone. The tibiæ were thickened, and over each was an ulcer, exposing the bone. Both knees were somewhat stiff, and were occupied by a good deal of effusion. The left elbow also contained fluid. The joints gave no pain. On September 4th, pus and granulation-tissue were removed from the swelling of the humerus and from that over the eyebrow. Subsequently the general health steadily declined. In December the patient was evidently suffering with lardaceous disease. The wounds never healed, and in January, 1886, a swelling appeared over the right acromion, and another below the left ramus of the lower jaw. He died on February 22nd.

Post-mortem examination showed disease of the skull indistinguishable from syphilitic gummatous inflammation; the lower jaw was carious. Considerable cicatricial tissue was discovered at the back of the pharynx. The liver and spleen were enormously, and the kidneys considerably, enlarged: all were lardaceous, as were also the intestines here and there in patches. The surface of the liver was scarred, especially on the left side and behind, and was puckered and contracted as if from condensation of fibrous tissue. In the *right shoulder-joint* the humerus showed gummatous ulceration of the shaft. The articular cartilage of the head of the bone was thinned in almost its whole extent, and was of a bluish colour. On the posterior aspect of the head, near the anatomical neck, was a deeply-cut groove extending for an inch or more towards the centre, after which it

turned towards the greater tuberosity and ramified over the greater part of the posterior surface of the head. The posterior portion of the articular surface looked as if areas of cartilage had been gouged away so as to leave irregular tracts with crescentic margins. Islands of cartilage here and there remained intact. In parts, the bone was involved, and had undergone the same serpiginous gouging process as the cartilage. Crossing the bone, and closely attached to it, was a thin membranous layer. When this was peeled off, the bone was rough, and softer than usual. The synovial membrane was more vascular, and thicker than natural, but otherwise appeared normal. The *right elbow* contained a considerable quantity of thick synovial fluid. Part of the cartilage of the trochlear surface of the humerus had become converted into fibrous tissue, but on the anterior part of the same surface there was a nodular proliferation such as is met with in osteo-arthritis. Elsewhere in the joint the cartilage was destroyed, and the bone exposed and roughened, and worn into grooves like those found in osteo-arthritis. The *left shoulder-joint* contained inspissated synovia. The articular surface of the glenoid cavity appeared normal, but the head of the humerus was affected in much the same manner as the head of the right bone. The *left elbow* was normal. The shins were covered with scars adherent to the bones. The tibiæ were thickened. The ankles and the joints of the feet were normal.

The *right knee* contained much viscid fluid. The synovial membrane was everywhere thickened and unduly vascular. The patella was surrounded by a mass of fringes, some pedunculated, others sessile. The external condyle presented a deep groove, which ran antero-posteriorly for an inch and a quarter. The groove extended down to, and involved, but did not expose, the bone, which was covered by a membrane

similar to that which lined the grooved portions of the shoulder-joints. At the upper and anterior part of the groove an island of cartilage remained intact. The cartilage on the upper part of the condyle was rough, fibrillated, and greatly increased in thickness. On the upper part of the internal condyle was a large nodular outgrowth of cartilage about an inch in length; elsewhere, in patches, the cartilage was fibrillated. In the *left knee-joint* the cartilage of the external condyle near the intercondyloid notch was deeply gouged in the manner already described as seen in the opposite knee. The destructive process had extended in a somewhat serpiginous manner, and had left islands of cartilage intact, but almost the whole of the cartilage of the anterior surface of the external and internal condyles had been removed, and much of the subjacent bone had been excavated. That part of the articular cartilage which had during life been in contact with the tibial tuberosities was for the most part natural, but in places was a little fibrous, and thickened by the growth of small nodular masses. The bottoms of the grooves were everywhere covered by a membrane, as was the case in the opposite knee. At the edges of the condyles were nodular outgrowths of cartilage, such as are commonly seen in osteo-arthritis; none of them were of large size; the external condyle was "lipped" in a very marked manner.

The cartilaginous surface of the patella was rough and fibrous, but there were no outgrowths round its edges. The cartilage of the tibia was slightly roughened, and at one spot, over the internal tuberosity, had been replaced by a soft mass of pulpy tissue, which intervened between the free surface and the subjacent softened bone. The cartilage covering the external articular surface of the tibia was normal, except beneath the semilunar cartilage: here its surface was fringed and

rough, and in parts slightly worn away. At its edges there was a little nodular thickening, but no definite lipping (Fig. 13).

Whatever view may be taken of the nature of this case, it must be allowed that it presented very unusual features. On the whole, I am inclined to regard it as

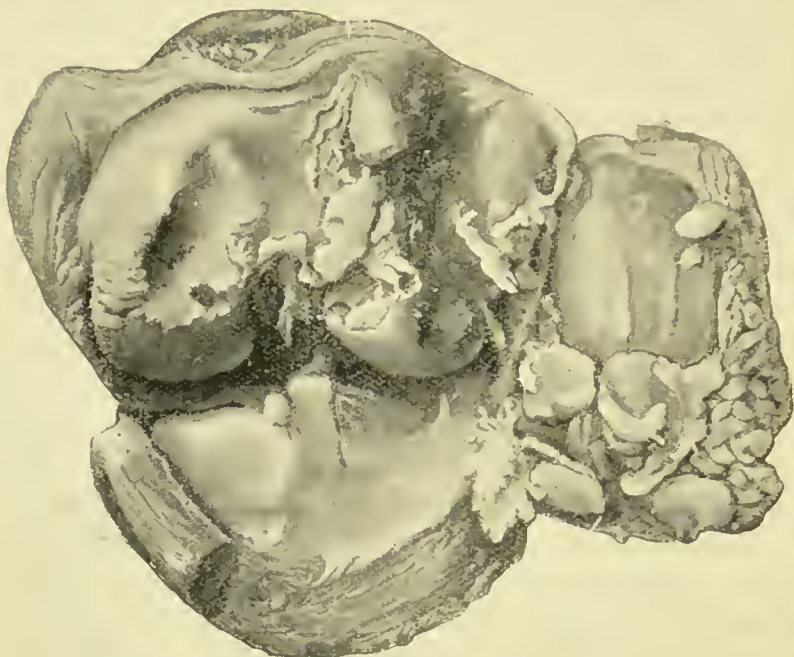


Fig. 13.—Mr. Bowlby's specimen of disease of the knee-joint in a case of congenital syphilis, showing the fringed synovial membrane and the gouging of the articular cartilage of the femur.

(From a specimen, No. 3121, in St. Bartholomew's Hosp. Mus.)

an example of congenital syphilis. The grounds for this conclusion are clearly indicated by the author of the paper. They are: "(1) the appearance of the affected bones, and especially the gummatous lesions of the calvaria, and the caries and thickening of the humerus; (2) the occurrence of extensive searring of the pharynx due to previous ulceration; (3) the searring and thickening of the capsule of the liver." Bowlby inclines to the view that the destructive pro-

cess originated in the bone in the form of a subchondral cavity, which led to an inflammation of the cartilage spreading from below towards the surface. In the same paper, which will well repay careful study, reference is made to the writings of Virchow, J. Hutchinson, jun., and others. All these sources of information indicate that, although the subject of syphilitic affections of the joints is imperfectly worked out, it is one which occupies a much wider field than has till lately been suspected.

Symptoms.—The first variety of syphilitic disease of the joints presents itself in the early period of the secondary stage, and consists of a subacute, slowly advancing synovitis, attended with stiffness, swelling, and sometimes tenderness of the affected joint, but with no alteration in the appearance of the skin, and with very little heat or pain, though some patients complain, especially at night, of neuralgia about the articulation and in the adjacent bones. The enlargement of the joint, due to effusion, is not very marked, as a rule, but in some instances it is considerable and very persistent. A peculiar feature of these cases is the manner in which the amount of effusion varies, sometimes nearly disappearing, then returning and remaining long stationary, and then perhaps undergoing a considerable increase. No other change in the synovial membrane is apparent than that of slight and slowly increasing and irregularly distributed thickening. Often even this cannot be detected. In short, the affection presents itself as a subacute synovitis, with no very distinctive characteristics. Hence the real nature of these cases is, as already said, apt to escape detection.

In the second and much better-marked variety, depending on gummatous infiltration of the subsynovial connective tissue, and described by Richet as “syphi-

litic white swelling," the joint is considerably enlarged, and the thickening of the synovial membrane can readily be made out, while often here and there distinct gummatous nodules may be felt. The affection is very indolent in its progress. In the later stages grating, due to erosion of the cartilages, may sometimes be made out, and movement may be gradually much impaired. Suppuration is rarely, if ever, met with. I have never seen it. The joints most often attacked are the knee, the elbow, and the ankle. I have seen no instances in the hip or the shoulder.

Thirdly, when the disease commences as an inflammation of the articular ends of the bones, the cases assume the same features as those just described, except that the enlargement of bone is earlier, and more distinctly marked, and nocturnal pains are more severe.

Diagnosis.—This turns on the history of the case in respect to syphilitic infection; the presence of other syphilitic manifestations, or the scars of bygone attacks; the irregular, and sometimes distinctly nodular or tuberos, thickening of the synovial membrane; the enlargement of the articular ends and adjacent portions of the shafts of the bones; the presence of nocturnal pains; the absence, in many cases, of previous rheumatic disease. Yet distinctive characteristics are often wanting in these cases, and error and oversight can only be avoided by bearing in mind that syphilitic joint-affections are not rare; that clinically they may resemble other forms of joint-disease, such as rheumatic, tuberculous, gonorrhœal affections; and that they must be suspected when any joint in a syphilitic subject becomes, without any obvious cause, and apart from previous rheumatism, the seat of chronic enlargement and the other symptoms above mentioned, which do not yield to non-specific remedies.

Recently a valuable test has been brought forward

by Wassermann, the Wassermann reaction, or the fixation-of-complement test, by means of which the syphilitic taint can be demonstrated in the great majority of patients who either have active syphilis or have been the victims of syphilis in the past. Although the majority of syphilitics give a positive reaction, it is not as yet definitely established that a positive reaction is indicative of past or present syphilis. The reaction is applicable to all stages of acquired and congenital syphilis.

So far as published results are available, it appears that about 90 per cent. of all known cases of syphilis give a positive reaction.

Treatment, in acquired cases, consists in the administration of potassium or sodium iodide. The latter should be used if potassium iodide is found too depressing. The dose is the same, and many patients with whom the potassium salt disagrees take the sodium preparation without difficulty. The quantity of iodide to be given to adults should, if necessary, be gradually increased up to 30 grains, or even more, three times a day. In cases occurring in the early period of the secondary stage, or in obstinate examples in the tertiary period, and in hereditary syphilis in young adults, mercury (best given in the form of the perchloride) should be combined with the potassium salt. In cases in which the ligaments are becoming softened, or in which the disease advances in spite of the use of antisypilitic drugs, it is necessary to support the joint and prevent deformity by the use of appropriate splints. The local application of mercury, in the form either of the oleate, or of the unguentum hydrargyri, is often of service.

When syphilitic affections of the joints occur in gouty subjects, they are apt to prove very indolent and intractable, and to show a strong tendency to relapse.

In such instances the antisyphilitic treatment must be combined with the remedies for gout.

The treatment in infantile cases consists in the use of mercury, in the form either of one grain of grey powder twice daily, or of inunction of the unguentum hydrargyri.

Should deformity be threatened, a light splint must be applied. These affections usually soon yield to treatment; but the mercurial course, in smaller doses, should be continued for two or three months after the symptoms have disappeared, in order to guard against a relapse, which otherwise is prone to occur. In young and weakly infants, however, if several joints are involved, death by exhaustion is by no means rare.

CHAPTER VI

GONORRHOÆAL ARTHRITIS

ALTHOUGH without doubt the arthritis about to be considered is a specific arthritis occurring in connection with a specific infective disease, it has not been included in Chapter VII., because the frequency of its occurrence in comparison with the other forms of infective arthritis seems to demand for it a special chapter.

Symptoms and pathology.—The course of gonorrhœal arthritis varies greatly according to the intensity of the infection. All practitioners are familiar with the symptoms—involving one, two, or several joints—of an arthritis developed in the course of an acute attack of gonorrhœa: rapid effusion, heat of the surface, and severe pain, associated with general illness and a high temperature. Here the gonococcus, being of full virulence and suddenly introduced in large quantities, produces the symptoms of an acute infection. But under other conditions infection by the gonococcus may present an entirely different picture. Take a case of slight gleet of long standing. Here the gonococcus is growing on an exhausted soil, so that its virulence is dwindling towards extinction; it is present in small amount, and it is probably growing in company with a streptococcus or some other organism, by which it is still further enfeebled. Placed in such circumstances as these the gonococcus may give rise to an arthritis which differs widely from an attack in the active stage of gonorrhœa. It produces none of the features of an acute inflammation. On the contrary, it acts all along

at a low grade of intensity; when a joint is attacked it gradually becomes enlarged, in part by some effusion, generally of quite limited amount, into its cavity, but chiefly by slowly increasing swelling of the synovial membrane and perisynovial tissue; pain, unless the joint is actively used, is slight, or entirely absent, and the surface is free from anything beyond a slight degree of heat; stiffness is usually marked, and there is the muscular wasting which invariably accompanies chronic arthritis of whatever origin. Such a case, instead of conforming to the usually accepted type of gonorrhœal arthritis, bears a very close resemblance, from a clinical point of view, to tuberculous disease. And the likeness is readily explained. It is due to the fact that, under the influence of its environment, the gonococcus has been deprived of so much of its original virulence, and is in such small quantity, that the degree of irritation which it produces is practically identical with that to which the tubercle-bacillus gives rise. The point is, as already stated, one of great importance, for undoubtedly many cases—for instance, of disease of the knee-joint—are diagnosed and treated as tuberculous when in reality they are not tuberculous but septic in their origin.

Some few years ago, A. B——, a man aged 27, was sent up to St. Bartholomew's Hospital for admission, as he was believed to be suffering from tuberculous disease of the right knee, of five months' duration. On examination all the symptoms fitted in exactly with this view—the considerable and uniform swelling dependent on "pulpy thickening" of the synovial membrane, and a little fluid in the cavity; the slight surface warmth, the stiffness, and the marked muscular wasting, together with pain, usually slight but becoming marked when any attempt was made to use the limb. To all appearances here plainly was a case of tuberculous disease. But it was ascertained that the patient had a very slight gleet remaining after gonorrhœa contracted nine months previously. A bougie was passed, and narrowing of the bulbous portion of the urethra

detected. The urethral dischargo was examined, and found to contain a few gonococci and streptococci. The urethral condition was set right by treatment, and in three months, under passive movement, massage, douching, and, later, gradually increasing exercise, the knee completely recovered.

Several joints may be involved in gonorrhœal arthritis; frequently, however, only one joint, and that a large one, is attacked. The knee most often suffers, but no joint is exempt. Even those of the fingers and of the spine may be involved. A very troublesome form is that which sometimes invades the ankle and contiguous tarsal joints, and in which the inflammatory process extends to the fibrous structures of the sole, and leads to an aggravated degree of flat-foot.*

The disease begins in the synovial membrane. Sometimes it is developed suddenly and takes an acute course, attended with rapid and large effusion and a temperature of 102° or more. Suppuration, though very rare, is occasionally met with. In other cases, inflammation is subacute, the effusion is only moderate, the inflammation is plastic in character, and the temperature is but little raised. Effusion may, however, be considerable and persistent. In some instances the surrounding structures are œdematous and the skin is red, as if suppuration had occurred; or they may be brawny and firm and the skin natural in appearance. Pain is usually severe—often intense, especially on movement. The affection frequently runs a chronic, tedious course, extending over several months. In mild cases complete repair, with restoration of free movement, takes place. But in many instances the inflammation assumes a plastic character and leads to firm fibrous, and occasionally even to complete bony, ankylosis. A man, aged 26, was under treatment at St. Bartholomew's Hospital whose right knee had become flexed at an

* *St. Bartholomew's Hosp. Repts.*, xviii. 34.

angle of about 110° , and stiff, after gonorrhœa contracted nine months previously. No movement could be detected. As the knee could not otherwise be straightened, excision was performed. During the operation the patella was found to be united by fibrous tissue to the condyles of the femur, and the tibia and femur were joined by firm fibrous ankylosis. At two points the external condyle was united by bone to the corresponding facet of the tibia. The cavity of the articulation was entirely obliterated. The arthritis may occur within a few days of the beginning of the urethral discharge, or may be delayed till only a slight gleet remains. The disease is irregular in its course, and periods of improvement are often followed by severe relapse. When several of the large joints are invaded the patient may be much crippled, and instances have been met with in which, in the course of repeated attacks, almost every joint in the body has become fixed. The disease is rare; that is to say, its percentage among cases of gonorrhœa is very small. Though met with in the female subject in association with gonorrhœa, it is almost confined to the male sex. It is remarkable that in some individuals this form of arthritis occurs with every attack of gonorrhœa. Sir Astley Cooper and later writers have described examples of this kind. The affection appears to be most common in gouty and rheumatic subjects.

The researches of Neisser* have enabled us to place gonorrhœal arthritis definitely amongst the infective diseases of joints. He demonstrated the presence of the gonococcus in joints affected with this form of disease, and showed that the pathological conditions can be reproduced by artificial inoculations of cultures of gonococci. Cases have also been recorded in which the inoculation of gonorrhœal pus for the cure of granular

* *Centralbl. f. d. med. Wiss.*, 17, 1879, p. 497.

lids has been followed by symptoms of arthritis. Mr. Clement Lucas* has drawn attention to the relationship which sometimes exists between ophthalmia neonatorum due to gonorrhœa, and synovitis of septic origin. In the cases of this affection which have come under his notice the children were affected with a synovitis about fourteen days after birth, and whilst they were being treated for a purulent conjunctivitis. The knees were most often the seat of inflammation, though it was also seen in the wrists. The synovitis was transient, and left no after-effects. In these cases Mr. Lucas was careful as far as possible to eliminate synovitis depending on syphilis.

Diagnosis.—The diagnosis in acute cases is readily made, but is by no means easy in the cases which arise after the attack of urethritis has subsided and only a slight gleet remains, which may be unobserved or even denied. In these cases a diagnosis of rheumatism is often made in the first instance. Here it is well to remember that an arthritis of urethral origin may arise independently of a gonorrhœal infection. Such cases may result from catheterisation or the treatment of strictures, and are clinically indistinguishable from the mild forms of true gonorrhœal arthritis.

Treatment.—In the treatment of acute cases the management of the gonorrhœa will not here be discussed. When proper measures are adequately carried out, the urethral discharge is soon under control, and absorption is limited or entirely prevented, so that no additional joints are likely to be attacked, while those already affected will be involved in no further contamination. The treatment of the arthritis must depend on the severity of the attack and the clinical variety of the affection. The most important point to bear in mind in all cases is that active treatment should

* *Brit. Med. Journ.*, 1885, ii. 58.

be immediately adopted in order that subsequent adhesions and ankylosis may be prevented.

In *acute* cases the limb must be placed at rest in good position, and a faulty position corrected by weight-extension, in the case of the knee or the hip. In every instance in which a joint is acutely distended, especially if the distension produces marked pain, it must be opened and washed out with saline or a weak antiseptic solution, and the wound closed. This treatment is so successful that it should be adopted without hesitation. Drainage is neither necessary nor desirable.

Some surgeons, in the case of the knee, in lieu of arthrotomy, perform aspiration with a large needle and syringe. M. Louis Queyrat, of Paris, adopts this method in the early stages of effusion, and then applies the actual pointed cautery (some 200 to 400 *pointes de feu*). After the cautery, firm compression is applied, and then, a few days later, passive movements are employed.

If aspiration is preferred to arthrotomy, it must be employed in the early stages of effusion, as in the later stages the fluid is largely replaced by masses of fibrin, which, if left behind, are responsible for the adhesions which so frequently result.

In some cases of acute gonorrhœal arthritis an anti-gonococcal serum has been found of considerable value. Major F. J. Porter, R.A.M.C., has reported some successful cases.*

In *subacute* cases there may be little, if any, effusion, but the morbid process is often very persistent, and the tendency to the development of new fibrous tissue very marked. In such instances multiple fibrous ankylosis may cripple the patient to a formidable extent. Active measures must be adopted to avoid such a calamity. Repeated blisters, mercurial inunction, and

* *Journ. of the Roy. Army Med. Corps*, Nov., 1907.

passive congestion by means of an elastic bandage (p. 57), followed by massage and passive movements, should be used, but it is well to warn the patient that in spite of these measures considerable damage to the joint may result.

In *chronic* cases in which fibrous ankylosis has already occurred, and a faulty position has been developed, some benefit may be obtained by movements under an anæsthetic. In not a few of the most severe cases, however, it becomes necessary to excise the knee-joint, or in the case of the hip to perform subtrochanteric osteotomy.

The question as to the value of passive movement is very important. Used prematurely—that is, while inflammation is still in progress—passive movement will do positive harm. By acting as a mechanical injury it will increase irritation, and lead to the further production of new fibrous tissue. However anxious the surgeon may be to avoid ankylosis, he will be well advised to withhold movements during this stage. I have often seen it used too early, and have noticed that it results not only in increased pain, heat, and swelling, but, even when these have subsided, in a less hopeful condition as to the future movement of the joint.

The time for the employment of passive movement comes later, when all active inflammation has subsided and the joint is free from heat (when this is the case the presence of pain is not a contra-indication).

When the joint is in a condition to allow of manipulation, considerable force—provided it is carefully applied—may be used, and may have to be repeated on two or three occasions. This should be combined with hot-douching, massage, elastic compression applied over a layer of cotton-wool, and daily passive exercise. As soon as possible the patient should begin voluntary

movements. In many cases potassium iodide combined with mercury is useful in promoting the absorption of adhesions. Much discretion, however, is required in estimating the force which may be applied. In many cases the joints are practically obliterated, and movements can only result in serious structural damage. Occasionally the new fibrous tissue becomes gradually ossified, and bony ankylosis finally results.

Recently, considerable benefit has been obtained from the use of bacterial vaccines in the treatment of various forms of chronic infective arthritis, and the following account of the use of vaccines in the treatment of gonorrhœal arthritis has been supplied by Mr. Girling Ball, who has been engaged in research work on this subject at St. Bartholomew's Hospital.

Value of serums and vaccines in the treatment of gonorrhœal arthritis.—As has been already stated, the diagnosis of this form of arthritis very largely depends on the recognition of the causal micro-organism either in the fluid from the joint affected, or else in the discharge from the genital organs or other organs in which the gonococcus may be found—e.g. the conjunctiva. Cases from time to time are met with, however, in which the micro-organism cannot be isolated. There are yet other methods by which the cause of the infective disease can be recognised—e.g. (1) observations on the curves of the opsonic index, (2) Bordet and Gengou's test for the deviation of the complement. Both these methods have met with success where the usual bacteriological methods have failed.

Vaccine-therapy.—At the present time this method of treatment is greatly in vogue, and there is a considerable amount of evidence to show that it is of value. With regard to the type of vaccine which should be used in any given case, there is some dispute. There are those who hold that wherever possible the vaccine should be prepared from the micro-organism isolated from the patient's own lesions; there are others who consider that it does not matter whether this or a stock vaccine is used, and that the results are equally good. ¹ The proper course to pursue is, if possible, to obtain a culture of the gonococcus from the affected joint, or, failing that, from the urethra or other local source of infection, and to prepare the vaccine from the

micro-organism. If this is not possible, then it is essential that a stock vaccine should be used. Whether this vaccine is prepared from a single strain or from a mixture of strains does not appear to be so important, as the biological reactions of a typical gonococcus are always the same. If a good stock vaccine has been prepared—that is, a vaccine which is known to have given good results—this can be used for most cases. The necessity of making a thorough bacteriological examination of these cases is strongly urged, as cases are on record in which the effusion into the joint has been found to be due to one of the secondary micro-organisms so commonly observed in the urethra in chronic urethritis. In these circumstances it is necessary to use a vaccine prepared from the secondary microbe combined with the gonorrhœal vaccine.

Dosage.—The dose of vaccine to be used is also a subject of dispute. There are those who say that only exceedingly small doses of vaccine should be inoculated, and others who hold quite the opposite view.

The best line to take depends on the general principle of vaccine-therapy, namely, that the more acute the disease the smaller should be the dose of vaccine used. In acute cases the dose should commence with 4 millions, rising gradually to 20 or 30 millions, with early intervals of two to three days, increasing to weekly inoculation as the dose increases.

In the chronic cases somewhat larger doses can be given at the initial injection, but this must depend on the strain of the vaccine, as some strains are much more liable to give violent reactions than others. As a general rule an initial dose of 5 millions can be given, rising by stages of 50 or 100 up to 500 or 1,000 millions, according to the course of the disease. During the inoculation of the smaller doses of the vaccine, three to four days' intervals, increasing to weekly or even longer intervals, are required.

In no circumstances is it advisable to push the dose so as to obtain a constitutional reaction, as the lesions are liable to be increased by such a procedure. A local reaction is to be aimed at, so long as that is not too severe.

The symptoms in the joints commonly following an inoculation of the vaccine are slight increase of the signs and symptoms, followed in twenty-four to forty-eight hours by a diminution of the same. The reaction of the first inoculation is, as a rule, the most severe, that following the subsequent inoculations diminishing with each injection. The average number of

inoculations required to bring about the requisite result is six, although this number may be increased or diminished as circumstances require.

The best site for inoculation is the forearm, and the injection should be given with due aseptic precautions.

Results.—The results of the use of vaccines in this disease are encouraging. The best effect is to be seen in the chronic cases, which lend themselves to vaccine-therapy much more readily than the acute cases. In cases where fever is present, this is usually lowered immediately, if the correct dose of vaccine has been employed. The relief of symptoms is as sudden as the lowering of the temperature. The disappearance of the effusion is slower. The stiffness of the joints also disappears. One of the striking features recorded by most vaccine-therapists is the absence of adhesions, so commonly seen in joints which have been treated by the usual methods. The use of vaccines in all cases of chronic gleet is strongly to be urged. Their use in acute cases must be determined by the merits of the individual case; e.g. the presence of a chronic urethritis which suddenly flares up.

Guides to treatment are (1) the opsonic index, (2) bacteriological investigations, (3) clinical symptoms. In the light of our present knowledge, the two latter are the more important, although in certain cases where the patient does not appear to be progressing as favourably as might be expected the opsonic index may be of value, provided the investigations are carried out by those who are in the habit of making these observations.

Use of serums.—Several varieties of serum have been used from time to time in the treatment of this form of arthritis. Antigonococcal serum, normal horse-serum, and antistreptococcal serum have all been used with success. The suggestion is that the effect of these very largely depends on the horse-serum from which one and all have been prepared. Fenwick and Parkinson record a series of successful cases in which the latter was given by the rectum with considerable success, but the advantages of the method over the subcutaneous inoculation of normal horse-serum do not appear to be very great. That the latter method has met with considerable success there appears to be no doubt. The combination of the serum with a vaccine may be strongly recommended.

CHAPTER VII

ARTHRITIS IN SPECIFIC INFECTIVE DISEASES

PNEUMOCOCCAL ARTHRITIS

THE discovery, in 1888, by Weichselbaum that the pneumococcus has the power of producing acute inflammation of joints was of the highest importance, not only on its own account, but because of the impetus it gave to the study of infective arthritis.

Léon Leroux, in 1899,* was the first to record a series of cases of pneumococcal arthritis in adults, in all twenty-six. Since that date the total of recorded cases in adults † has reached upwards of sixty. Of these, five were purely arthritic and may be styled "primary"; the remainder were associated either with pneumonia or with some other pneumococcal lesion. Out of thirty-eight recorded cases ‡ in infants and young children, six were primary—a higher percentage than in adults.

Pneumococcal arthritis is a rare disease, particularly in its primary form, though probably in the latter case less rare than the figures just quoted would suggest; for in the past many examples must, in the absence of bacteriological investigation, have escaped recognition.

As regards the frequency of the secondary form, Nathan Raw§ states that in the Mill Road Infirmary, Liverpool, he had in four years 817 cases of acute

* "Les Arthrites Pneumocoques" (Paris, 1899).

† By Cave, Pasteur and Courtland, Wrangham and Seeretan, and others.

‡ By Dugdeon and Branson, and Hertzog.

§ *Brit. Med. Journ.*, Dec. 21, 1901.

pneumonia under his care. In these 817 cases arthritis showed itself in seven: six were suppurative and one serous; four recovered and three died.

Pathology.—Drs. Pasteur and Courtland* have given an admirable account of the pathology of this affection. They point out that the *Diplococcus pneumoniae* is almost constantly present in the saliva, and that it is a frequent agent in the production of sore throat, and is ready, whenever the occasion offers, to effect an entrance into the blood-stream, and to produce, among other lesions, an infective arthritis.

When arthritis follows well-marked pneumococcal lesions, such as pneumonia, otitis media, or meningitis, the mode of entry is obvious.

When “primary” cases occur it is easy to assume slight inflammation of the fauces, followed first by stasis and it may be thrombosis, and then by invasion of the blood-stream by organisms hitherto held in check by the filter-like action of the adenoid tissue; or it may be that the organisms find a way through undamaged tissue. If the former is the case, then the distinction between “primary” and “secondary” is but slight. The conditions associated with the primary type are far more favourable to a successful issue than those in secondary cases. In the former the point of entry is so minute as to have escaped detection; yet it has permitted the entrance of a small batch of organisms into the circulation—organisms which, alighting on a joint whose resistance is diminished by injury or some other cause, set up an arthritis; but the supply from the primary focus ceases with the healing of the tissues concerned, and so the intensity of the infection is limited. It may, of course, happen that from the joint-focus a general infection arises—a pneumococcal septicaemia. This, however, is a rare event.

* *Lancet*, June, 1906.

On the other hand, the conditions are very different in a case arising during an attack of acute pneumonia. The initial lesion is a gross one, the resistance at the primary focus is but slight, and the supply of cocci to the blood is continuous. These views are borne out by the high mortality, viz. 65 per cent. in secondary cases as against about 25 per cent. in the primary cases which have so far been recorded.

Leroux reports two cases, and Raw one, of arthritis preceding the pneumonia, by three, seven, and two days respectively. It may be that in such cases the infection of the joint takes place during the incubation period of the pneumonia, or possibly the pneumonia is secondary to the joint-invasion. These cases have not, therefore, been included in the records of "primary" arthritis, although the presumption is in favour of their being so classified.

Experiments with mice and rabbits have demonstrated the susceptibility of joints to the pneumococcus, especially after mechanical injury. Ausset inoculated mice and rabbits with cultures of the pneumococcus subcutaneously, after applying mechanical injury to the joints, and a purulent arthritis resulted in seven cases out of ten. Zuber obtained similar results by injecting turpentine into the joints, and pneumococci subcutaneously. Kasperek demonstrated the susceptibility of joints to infection in a limb after section of the sciatic nerve.

Benzançon and Griffon,* going further, have inoculated normal rabbits with attenuated cultures, and partially immunised rabbits with virulent cultures, and have found in both instances that though the animals developed localised joint-lesions some time after inoculation, they did not die of general infection in twenty-four to forty-eight hours, as is usually the case. These

* Soc. de Biolog., July, 1899.

observers failed to recover the organism from the tissues post-mortem, and found the serum protective against experimental inoculation and agglutinative to pneumococci. These experiments demonstrate the readiness of pneumococci of attenuated virulence to attack joints in animals, and the susceptibility of damaged tissues to pneumococcal infection. As an example of the influence of injury in determining the seat of attack, a case recorded by Billings may be mentioned. A man shortly before the crisis of pneumonia became delirious and jumped out of a second-story window, injuring his left shoulder and right knee. Some days after the crisis both joints became acutely distended with pus containing pneumococci. In another case, recorded by Nattan-Larrier, a child, born after a prolonged labour, received some injury to the shoulder. When three days old it was operated on for hare-lip. The lip did not heal well, and subsequently discharged pus. The child became very ill and developed an acute suppurative arthritis in the injured shoulder. The pus from both the lip and shoulder was found after death (a few days later) to contain pneumococci.

The **clinical history** and **treatment** of a primary pneumococcal arthritis are well illustrated by the following case: * A man, aged 23, was admitted into hospital with an acute inflammation of the right knee-joint. His family history was excellent, and he had always enjoyed good health. He had never had gonorrhœa. He had a slight injury to the right knee, four months previously, through a fall off a bicycle. On the day before admission he had experienced a slight pricking sensation in the joint. This soon gave place to pain, which compelled him to lie down, but the onset of the illness was not attended by any sore throat or feeling of malaise. On admission the temperature was 102°.

* Pasteur, *Lancet*, June 23, 1906.

The knee-joint was visibly distended, very tender, and acutely painful. No other joint was affected. The tongue was furred, the throat healthy. There was nothing abnormal in the chest, and the urine was natural. Fomentations were applied, and sodium salicylate prescribed. For the first four days the knee continued to increase in size, but the pain became more bearable. On the fifth day the temperature, which had gradually fallen to normal, rose again to 102° , and continued to oscillate until after the operation (a fortnight later), when it rapidly subsided. On the fifteenth day the joint was aspirated and three ounces of thin, greenish-yellow pus withdrawn, which on microscopic examination revealed diplococci. Three days later the joint was opened by a longitudinal incision on either side of the patella. A large quantity of greenish pus was evacuated, the joint irrigated with boric lotion, drained, and dressed with gauze. The patient rapidly improved. Irrigation was continued for a few days, and a fortnight later the discharge ceased. A few weeks afterwards the patient had regained his general health, and the joint was freely movable. Pure cultures of the pneumococcus were subsequently obtained from the pus, but animal inoculations were negative.

This case illustrates a monarticular arthritis, almost certainly of pneumococcal origin, in which no primary focus could be found.

In most instances, though not in the case just recorded, a noticeable feature is a sudden commencement, resembling the rapid onset of pneumonia.

Many cases have shown a tendency to recrudescence when treated merely by aspiration; and in some, even when the effusion has subsided spontaneously, there has been recrudescence.

In the instances which occur during an attack of pneumonia, the symptoms will not differ from the above,

nor will the diagnosis be difficult. The prognosis must of necessity be very grave, and treatment by free incision, evacuation, and irrigation must be prompt if recovery is to be hoped for. Some cases end fatally in a general septicæmia, and in one case occurring in a pregnant woman, recorded by Luigi Fornaca, the pneumococcus was cultivated from the blood, urine, and milk.

PNEUMOCOCCAL ARTHRITIS IN CHILDREN

Hertzog* has summarised the records of twenty-eight cases, all under the age of two years. Of these he found that in ten the knee was alone affected, in seven the shoulder, in four the elbow, and in two the ankle. In each of the remaining five instances several joints were involved. No fewer than eleven cases in the total were free from pulmonary complications.

Pathology.—The most probable primary focus is the middle ear. Netter,† in thirty-one autopsies on infants under three years of age, all of whom were suffering from pneumococcal lesions, found suppurative otitis in twenty-nine. Nitch,‡ in examining two cases of pneumococcal infection, found suppurative otitis in both, and demonstrated the organism in one. Dudgeon and Branson§ state that in their experience “the pneumococcus practically monopolises the etiology of infective arthritis during infancy and up to the end of the first hemi-decade.” In two out of the five cases recorded by them there was an accompanying otitis media, in one a preceding pneumonia, and in the remaining two the joint-affection was the only discoverable lesion.

The anatomical appearances are similar to those of other forms of suppurative arthritis, but the destruc-

* *Jahrb. f. Kinderheilk.*, April, 1906.

† *Comptes Rendus de la Soc. de Biolog.*, 1890.

‡ *Brit. Med. Journ.*, Sept. 21, 1907.

§ *Lancet*, Aug. 1, 1903.

tive changes are less marked. In three cases Hertzog observed that the capsule was thickened and that the synovial membrane was infiltrated with both mononuclear and polymorphonuclear cells. A section stained by Gram's method showed a few diplococci uniformly distributed. In one case there was distinct evidence of pneumococcal septicæmia: the organisms were found in the spleen, lungs, and bone-marrow, but not in the liver or kidneys. The diplococcus was identified as the pneumococcus, and confirmed by inoculation experiments. The explanation offered of the frequency of such joint-affections in children is the large size of the capillaries in the bone-marrow, exceeding that of the smallest arteries; whereby the blood-current is rendered extremely slow and the deposition of infective organisms in the tissues favoured.

Symptoms.—The clinical features are characteristic. The skin, especially of the face, is pale, in spite of the fever, which is usually irregular. There may be no disturbance of the appetite or of digestion, and the child sleeps well, a point previously noticed by Dudgeon and Branson, and a distinctive one. The local condition is that of marked swelling around one of the joints, accompanied in severe cases by œdema often involving almost the whole limb. There is tenderness on pressure, with increased heat, but often no redness—a distinguishing feature between this and other forms of acute arthritis. In rare cases there may be unusual mobility. The pus is found to be free from offensive odour, of creamy consistency, and greenish-yellow in colour, and it frequently deposits threads of fibrin.

It is well to remember that the inflammation does not necessarily go on to suppuration, as the following case, recently seen, illustrates:

A child, aged 5, was admitted on the fourteenth day of an attack of acute double pneumonia. The

left thigh was flexed and abducted, movements at the hip-joint were very limited, and any attempt at movement caused excessive pain. There was some swelling in front of the joint, both on inspection and by measurement, in comparison with the opposite side, but no redness or œdema.

Weight-extension was applied to the limb, and the child treated for the pneumonia, which was resolving at the time of admission. Although the condition of the lungs seemed to improve, the temperature remained high, with morning remissions. There was an increasing leucocytosis, and an empyema was suspected, in the absence of any obvious change in the signs at the hip-joint. As the physical signs of an empyema could not be detected, it was decided to explore the joint. On opening the capsule it was found that the synovial membrane was intensely congested, and, at the line of reflection on to the femur, thickened and spongy and almost villous in character. There was no appreciable fluid in the joint. The joint was washed out with a weak solution of perchloride of mercury and the capsule closed, a portion of the thickened synovial membrane being taken for microscopic examination. Subsequent exploratory puncture of the left side of the chest revealed an empyema, which was opened and drained. This again was followed by an empyema of the opposite side, but the signs of inflammation in the hip-joint gradually subsided. The pneumococcus was obtained in pure culture from the pus of the empyema on both sides. It is possible that in this case suppuration in the hip was prevented by the incision and irrigation; on the other hand, the signs in the joint had been observed ten days previously to operation, and suppuration would probably have occurred by that time if it was ever to take place. The hip recovered without any impairment of function.

PNEUMOCOCCI. POLYARTHRITIS.

T. GERALD GARRY (Cairo) writes with reference to Dr. Gubb's paper: Cases similar to that he describes were very frequent as sequel to bacillary dysentery (from which apparently his patient suffered) among soldiers in the Near East during the war, and generally recovered under appropriate antidyenteric treatment, without ever ending in uncomplicated cases of suppuration. I think it extremely probable that examination of the faeces would have cleared up some doubtful points, and that the "numerous pneumococci" could not be attributed the *et origo* of the malady. 37, 7. 5 11 2. 24.

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Diagnosis.—The diagnosis in these primary cases has to be made from gonorrhœal, syphilitic, and tuberculous arthritis (*see* former chapters), and from joint affections due to the staphylococcus or streptococcus. In the last two conditions the general symptoms are usually more severe and the local conditions are associated with more inflammatory redness. The diagnosis rests with the microscope.

Prognosis.—The prognosis is grave. Of the twenty-eight cases recorded by Hertzog, fourteen recovered and eleven died (the fate of the remaining three is not stated). The character of the pus is a valuable guide in prognosis, as in cases of empyema. If the pus is thick, contains much fibrin and few organisms, and these in chains, not actively dividing, the prognosis is much more favourable than if the pus is thin and contains many diplococcal forms. The former condition is indicative of a local lesion, the latter of a septicæmia.

Treatment.—The best treatment is early incision and irrigation. If pus is present, any fibrinous threads must be carefully removed, and the joint must be drained. Deformity from muscular contraction must be guarded against by the judicious use of splints and weight-extension.

ARTHRITIS IN TYPHOID FEVER

Since attention was first drawn to this subject by Parise, in 1842, several writers have alluded to it and recorded their observations. Among these may especially be mentioned Keen, of Philadelphia, who in 1898 published his important monograph on the complications and sequelæ of typhoid fever—including a chapter on affections of the joints—and Barjon and Lesieur, whose essay on “Septicémie Eberthienne” was published in 1901.

Keen, placing himself in line with previous writers,

states that there are three forms of joint-disease met with in association with typhoid fever :

1. Rheumatic typhoid arthritis.
2. Typhoid arthritis proper.
3. A form of septic arthritis.

1. Under the head of **rheumatic typhoid arthritis** are placed cases in which at the commencement of the illness—sometimes as the earliest symptom—the patient complains of severe pain in the knees, elbows, or other joints, which are the seat of varying degrees of swelling. Usually the affection lasts for a few days and then disappears, without leaving any ill effects. In other instances effusion increases in quantity and suppuration occurs. As a good example of this early form, Dr. Percy Kidd has given me notes of the following case :—

A girl, aged 17, was admitted into the London Hospital, on December 9th, 1899, having complained for two or three days of pain in her left knee, which was swollen. Her case was at first regarded as one of acute rheumatic arthritis. The knee, however, became worse, and on the 14th was explored, as suppuration was suspected. No pus was found. Two days later the temperature was 105° , and diarrhoea, faint rose spots, and Vidal's reaction disclosed typhoid fever. Death occurred sixteen days later from intestinal hæmorrhage, and typhoid ulcers were found in the intestines. The joint-affection had subsided. Unfortunately, no bacteriological examination was made.

To speak of these cases—not that Dr. Kidd does so, and Keen is merely quoting—as rheumatic typhoid arthritis because they in some respects resemble acute rheumatism is but another example of the confusion which results when terms which themselves are (in the absence of precise knowledge) virtually meaningless are so used as to suggest pathological theories. The real nature of these cases is at present undetermined. But it seems likely that the joint-condition will prove, on further investigation, to be directly due either to

the typhoid bacillus itself or to some irritative toxin to which it gives rise.

2. Typhoid arthritis proper.—This is met with in the acute stage of typhoid fever, or towards its decline. Occasionally it makes its appearance during convalescence. Its features vary in different cases. Several joints may be involved (polyarticular form), or it may be limited to one (monarticular). In the former, two, three, or more of the large joints may be attacked. There is pain, together with more or less swelling, due in part to infiltration and thickening of the synovial membrane, and in part to the effusion of turbid fluid into the joint-cavity. In some instances the attack subsides and recovery follows. In others, the joints, after prolonged inflammation, undergo fibrous ankylosis, which can be removed, if at all, only by repeated manipulation under an anæsthetic and prolonged passive movement and massage. Or, again, suppuration may ensue, necessitating free incision and irrigation.

Typhoid spondylitis is a rare sequel of typhoid fever which manifests itself during convalescence by painful stiffness, swelling, and tenderness of the lumbar spine. It appears to be due to serous inflammation of the periosteum and adjacent structures (perispondylitis). In the *American Journal of the Medical Sciences* for December, 1906, Professor Thomas McCrae, of the Johns Hopkins University, records a case, and has shown that definite bony changes may result—a fact which does not appear to have been observed previously.

In the monarticular variety it is the hip which in the great majority of cases is involved, and the result is usually serious, for some cases end in firm fibrous ankylosis much resembling that which ensues after gonococcal infection, while in others (and much more frequently) the capsule becomes distended by serous effusion, and then spontaneous dislocation may occur.

The *pathology* of this group of cases is as yet but imperfectly worked out. Such evidence, however, as is at present available tends to indicate that the arthritis is due to the local action of the typhoid bacillus on the tissues concerned. It is well known that, although the typhoid bacillus is not usually present in the general circulation, it is to be found in the liver and the spleen, in bone-marrow, in the rose spots on the skin, and in the urine; in other words, that it is widely distributed in the tissues. It is therefore easy to suppose that along with other parts the joints may be invaded by it. Positive evidence, however, of the presence of the bacillus in the joints is as yet very limited. Several observers who have examined fluid withdrawn from joints in these cases have found that it was completely sterile. But too much weight must not be attached to this negative result.

Possibly the bacillus, although originally present, subsequently undergoes disintegration. It is not rare to find collections of pus in various parts which are sterile but which almost certainly were produced by micro-organisms now no longer to be found, and Cave remarks that even in some cases of suppurative arthritis occurring in association with pneumonia the pus removed from the joint has been sterile. Yet in such cases it is nearly certain that the pneumococcus was originally present. Or the explanation suggested by Widal, that the arthritis was produced not by the pneumococcus itself but by toxins derived from it, may be correct—a view which may also be held in the case of the arthritis of typhoid.

On the other hand, Delanglade and Chibret found the typhoid bacillus in the joint-fluid, while Orloff produced arthritis by injecting the bacillus into the joint of a rabbit. Further observations are required to determine the real origin of the form of arthritis under dis-

cussion, but at present such evidence as we possess points to the conclusion that the typhoid bacillus may produce arthritis by its specific action on the tissues, just as may the gonococcus or the pneumococcus.

3. **Septic arthritis.** — It will readily be understood, when the condition of exhaustion to which the patient is reduced by typhoid fever is borne in mind, that septic arthritis is a highly dangerous complication. It is, in fact, very generally fatal. It, however, presents no specific characters. It is an instance of the common form of septic infection, and is due to the presence of streptococci or staphylococci which have been absorbed from boils, or bedsores, or from the surface of intestinal ulcers. Perhaps the *Bacillus coli communis* may also in some instances be concerned, but as to this there is no positive information.

ARTHRITIS IN SCARLET FEVER

The arthritis which is not very rarely associated with scarlet fever occurs in two forms. The first is often indistinguishable, clinically, from acute rheumatism. It makes its appearance either quite early—while the rash is still present—or during the desquamative period. It usually involves several joints, is not severe in character, and, in the majority of cases, soon subsides. As to its pathology, Dr. Hilton Fagge remarks: “Probably most cases of synovitis following scarlet fever are true rheumatism.” Osler regards it as analogous to gonococcal arthritis; and Dr. F. Taylor holds practically the same view, for he says: “Although known as scarlatinal rheumatism, it is possibly an arthritis due to the direct action of the septic organism of the primary disease.” This, in the present state of our knowledge, and judging by such instances as the pneumococcal, gonococcal, and probably also typhoid arthritis, is likely to be the correct view. The second form is much more severe, and not

rarely ends in suppuration. It is usually, as Strümpel remarks, a part of secondary sepsis or of a general pyæmia as evinced by such other lesions as empyema, subcutaneous abscesses, splenic tumour, etc. Here, as in the septicæmic form of typhoid arthritis, the infective agent is the streptococcus pyogenes, or the staphylococcus.

ARTHRITIS AFTER INFLUENZA

I have met with the two subjoined cases, and they appear to suggest that, with whatever rarity, arthritis may follow influenza. On this subject Bonecounie has written a paper.* His observations, however, refer not to any specific form of arthritis directly dependent on influenza, but to the predisposition which influenza establishes to attacks of ordinary gout. The subject is one about which little is known, but it seems possible that these cases of Bonecounie's which resembled gout may have been due directly to the action of the influenza bacillus.

The first case was that of a gentleman, aged 42, who had a sharp attack of influenza (which was at the time epidemic in his neighbourhood) on May 3rd, 1891. Two days later he complained of severe pain, apparently in the glands, below Poupart's ligament; he had a rigor, copious sweating, and a temperature, for the next ten or twelve days, ranging between 102° and 103·5°. During this time nothing abnormal could be detected in the groin or thigh, till on May 11th a band of œdema appeared running down the outer side of the limb from the trochanter nearly to the knee, but this was neither painful nor tender. Pain was situated chiefly in Scarpa's triangle, on the inner side of the femoral vessels. There was a tender spot also over the sciatic notch. On May 14th the temperature went down and the œdema subsided, but some thickening could be felt in front of the joint, and the artery seemed to be pushed forward. At this time the limb was becoming flexed and abducted. There was marked muscular wasting, and pain about the joint was so severe as to call for the hypodermic injection of

* *Bull. Gén. de Thérapcut.*, 1900, cxi. 5.

morphine. I first saw the case on July 5th. The patient was very weak; temperature was 101° to 103° ; the limb was flexed and adducted; there were night startings and much muscular wasting. Any attempts to move the limb produced severe pain. It was obvious that the joint was actively inflamed. Weight-extension in the axis of deformity was used. The symptoms gradually subsided, and the patient gained flesh and strength and was able in about two months to be up on crutches. When I saw him again in the following December there was $\frac{3}{4}$ inch of real shortening and some adduction of the limb; the trochanter was considerably above Nélaton's line. The joint was stiff, but all active symptoms had ceased. At the present time the patient walks with a stick, but lameness is marked. He has only fatigue-pain. No further shortening has taken place. Anyone who now examined the limb would probably regard the case as one of monarticular osteo-arthritis. A few days after the hip was attacked the patient complained of pain in the knee, which was enlarged from periarticular infiltration. There was no fluid in the synovial cavity. This condition persisted for four or five weeks, but then slowly subsided. The joint ultimately completely recovered.

In the second case, a boy, aged 18, after a moderately severe attack of influenza, complained of stiffness and intense pain about the right hip. On his admission, two months later, into St. Bartholomew's Hospital, the limb was flexed and abducted, the joint was stiff, and there was much brawny œdema of the soft parts in Scarpa's triangle, in the iliac fossa, and on the outer side of the joint, and below and a little internally to the iliac spine there was a suspicion of fluctuation. The inguinal glands were enlarged. The muscles were wasted. The position of the limb was corrected by weight-extension, and swelling slowly subsided, but stiffness remained. The brawny thickening persisted for several months, and suppuration often appeared imminent but did not occur. At present the joint is stiff. There is no pain; thickening around the joint remains to some extent. The patient walks with only slight lameness.

Drs. Dudgeon and Adams* have reported a very interesting case of multiple arthritis and meningitis due to the influenza bacillus, in a child ten months old. The illness commenced with a swelling round the head

* *Lancet*, Sept. 7, 1907.

of the radius, rapidly followed by acute suppurative arthritis of the elbow-joint, which was treated by incision and irrigation. The child's condition grew steadily worse, and death followed shortly after from meningitis. Cultures were taken from the pus in the elbow-joint and the hip-joint (in which an abscess was revealed post-mortem), from the cerebro-spinal fluid and the spleen, and in each case pure cultures of the influenza bacillus were obtained.

ARTHRITIS IN DYSENTERY

In some epidemics, as in an outbreak in Germany in 1901, arthritis is rather a frequent sequel. In the South African War many of the soldiers suffered from arthritis following dysentery. Beveridge* found that 3 per cent. of the cases under his observation were so affected.

The onset usually occurred when the more urgent symptoms of the dysentery had subsided, and when the temperature had dropped to normal or nearly so. A sudden secondary rise of temperature was followed by a rapid effusion into one or several of the larger joints, most frequently the knee, elbow, or ankle. In several cases the effusion was preceded for from twelve to twenty-four hours by pain in the joints. The joints became uniformly swollen and excessively painful, but there was little heat or redness and no tendency to suppuration. In from eight to twelve days the effusion subsided, and beyond a little stiffness no untoward results occurred, nor was there any tendency to recurrence. The temperature was irregular, and septic in type. Bruce† records that a micrococcus was frequently found in the fæces of cases of acute dysentery. Beveridge isolated a micrococcus from the blood in most

* *Journ. Roy. Army Med. Corps*, Dec., 1905.

† Report, Dysentery and Enteric Commission, Pretoria, 1903:

of the cases of arthritis, but never in cases uncomplicated by arthritis.

These cases of arthritis in dysentery rather closely resemble some of the cases of true typhoid arthritis already described.

ARTHRITIS IN MALTA FEVER *which is now almost unknown.*

Arthritis not infrequently occurs in the course of Malta fever. In these cases many joints may be involved at the same time; the effusion is but slight, but the joints are exquisitely tender. When the sacro-iliac joint is involved, the least movement causes the most intense pain: the patient dreads a change of position, and will avoid evacuating the bowels and risk bed-sores rather than be moved.

Arthritis also occurs in the course of *glanders*, *variola*, *measles*, and *diphtheria*, and has, in several cases, been noted in *meningococcal* infections.

Acute rheumatic arthritis, though possibly due to a diplococcus of specific nature, will be discussed in a separate chapter.

ETIOLOGY OF SPECIFIC JOINT AFFECTIONS

The principal instances in which the joints are liable to infection in the course of the various specific diseases have now been briefly reviewed, and it will be apparent that the infective agent is different in different cases. In some cases it is the same micro-organism (or its toxins) as that which produces the primary disease—as, for example, when acute arthritis occurs as a complication of pneumonia, and the pneumococcus is found in the joints; or when arthritis, developed in the course, or as a sequel, of typhoid fever, depends on the local action of the typhoid bacillus.

The arthritis found in association with scarlet fever appears to be a mild form of septicæmia due to the

streptococcus pyogenes, while that which is sometimes met with in dysentery may be the result of a mixed infection, in which, perhaps, Shiga's bacillus and the *Bacillus coli communis* play a part.

In studying these infective agents, it is to be remembered that the effects which they produce may be largely influenced by the varying conditions under which they are placed, as determined, for example, by the resisting power of the individual attacked, the dose received, and the presence of other micro-organisms or their toxins. These are matters about which at present little is known. Little, for instance, is known as to the influence which the typhoid bacillus or its toxins may have in modifying the action of the streptococcus or the staphylococcus, or vice versa.

INFECTIVE-JOINT CHANGES

The changes met with in joints which are the seat of infective arthritis vary considerably in different instances. In a *first* group of cases they are slight and transient, and result from synovitis, attended with infiltration of the subsynovial tissue and with some, but only a limited, serous effusion into the cavity of the joint. This is the case, for example, in the arthritis which occurs in the early stage of scarlet and of typhoid fever.

In a *second* group, one, two, or more of the joints are painful and swollen from effusion of fluid into the synovial cavity. These are the cases which have been so misleading in consequence of the close similarity of the appearances observed, on clinical examination, to those of acute rheumatism. Although at first, as I have said, merely turbid, the fluid in the joint in some cases soon becomes purulent.

In a *third* group the inflammatory process chiefly involves the periarticular tissues, and leads to consider-

able brawny or boggy swelling, and to reddening of the skin, which is at the same time so stretched and shiny as to suggest the presence or near approach of suppuration. This is one of the most clearly-marked types of infective arthritis, and one with which we have long been familiar in some of the cases of gonococcal infection. In this form there is frequently no effusion into the cavity of the joint, and, so far as I am aware, suppuration, though it seems imminent, very rarely occurs.

A *fourth* group of cases includes those in which the arthritis is, from the first, acute and destructive. Suppuration takes place early, and goes rapidly on to complete disorganisation of the joint, and often to the wide burrowing of pus, which has escaped from the synovial cavity, along the intermuscular spaces of the limb. This fourth variety is met with in its most marked phase in pneumococcic arthritis.

PROGNOSIS AND TREATMENT

In the *first* group—that, namely, which consists of a transient synovitis, attended with limited effusion—prognosis is favourable. The arthritis soon subsides, often in the course of four or five days, and the joints completely recover. A suitable splint and warm fomentations will be the only treatment required.

In the *second* group, in which the joint-cavities contain fluid, the treatment imperatively called for is clear. It is the same as that which should be employed in gonococcal infection. The fluid must at once be removed, and the joint freely irrigated, either with carbolic lotion 1 in 100, or with mercurial solution, of which, perhaps, the best form is biniodide 1 in 2,000. To evacuate the fluid, a full-sized hydrocele trocar and cannula may be used, and irrigation can be readily performed through the cannula; or the joint may be opened by an incision at the side of the patella. If the fluid proves to be

already purulent, the joint must be freely opened and the finger inserted to break down any adhesions which may have formed, and behind which pus might be imprisoned, and then thorough and copious irrigation must be carried out. The immediate improvement and complete recovery sometimes observed after evacuation and irrigation was very striking, and has its parallel in what many surgeons will have found in cases of pyæmia, namely, that when a joint has become distended with pus, if it is freely opened and copiously irrigated it may forthwith undergo striking improvement and, if the patient survives, may completely recover and retain absolutely free movement.

In the *third* or plastic form prognosis is distinctly unfavourable. The arthritis is prone to extend over a considerable period. A large amount of new fibrous tissue is developed both between the articular surfaces and in the periarticular tissues, and the joint is thus converted into a massive scar, firm fibrous ankylosis, which may subsequently become bony, resulting. This strong tendency towards ankylosis is one of the especial characteristics of infective arthritis; nor is any means at present known by which it can be prevented. As to treatment, the best that can be done is to keep the joint for the time being at complete rest; indeed, the pain is such that no alternative can be thought of. Warm boric or opiate fomentations are required during the most acute stage, but when swelling and heat have somewhat subsided a succession of small blisters will alike relieve pain and promote absorption. In the experience of some surgeons the subcutaneous injection of fibrolysin has proved of value in promoting absorption. Later still, massage will be required to remove the brawny œdema of the soft parts. A very important question is whether, in any of these cases, manipulation should be employed with the object of restoring movement. In

the slighter cases this is advisable, but when inflammation is either severe or prolonged the joint becomes filled up with cicatricial tissue and the restoration of movement is impossible. Forceful manipulation in such conditions is not only useless, but definitely mischievous, for it renews irritation and promotes the formation of scar tissue. Moreover, instances have occurred in which manipulation has left a joint, which was previously free from pain, so sensitive and painful for many weeks that it was necessary to keep it at complete rest, so that, instead of being diminished, stiffness was increased. The treatment of gonorrhœal arthritis has been dealt with in Chapter VI.

In the *fourth* group prognosis is highly unfavourable, for the arthritis is but one of the manifestations of a general septicæmia, and is frequently associated with other lesions of the gravest kind. Often the arthritis is rendered comparatively unimportant—except for the suffering it entails—by the speedily fatal termination of the case. In those rare cases, however, in which the septicæmia is of a milder type, and other local developments are absent, if the joint is at once freely opened and irrigated, repair may take place, sometimes with ankylosis, sometimes with the restoration of considerable or even completely free movement.

In the future, when our knowledge of pathology has become more exact and when each infective agent can, as we may hope, be opposed by an appropriate serum or vaccine, these cases may be treated with much more success than is at present possible.

CHAPTER VIII

SEPTIC ARTHRITIS

UNDER the term "septic arthritis" will be included all those cases of infection of joints which cannot be classed under the well-defined headings that form the titles of previous chapters. Thus gonorrhoeal arthritis, though a septic arthritis, has a separate identity, and the same may be said of the pneumococcal infection and other joint-lesions which occur in the course of specific infective diseases. But there remain a large number of cases which, though specific as regards the invading organism (usually a staphylococcus or a streptococcus), fall into a general clinical group that may be best described as "septic." For purposes of description they may be subdivided into (1) the local infections, direct and indirect; (2) the acute general blood-infections, and (3) the subacute blood-infections.

In other words, there are the septic joints which follow wounds, the acute pyæmias, and the somewhat obscure cases of septic arthritis which frequently baffle treatment until some septic focus, often insignificant in itself, such as a carious tooth, is discovered and treated. These cases will be dealt with somewhat fully, in view of the fact that in practice their true origin is often undiscovered. The local infections have already been discussed in Chapter I.

GENERAL BLOOD INFECTIONS (ACUTE PYÆMIA)

General pyæmic infection is, fortunately, at the present time decreasing in frequency. In its course

the joints are frequently attacked. In acute cases the tendency is for many articulations to be affected in rapid succession, so that in two or three days several may be implicated, while in the more chronic cases also several joints may become involved, though at longer intervals.

The most common form of arthritis in pyæmia is a synovitis characterised by the rapid development of a considerable collection of pus, unattended, however, in its early stage by the signs which are usually met with in acute inflammation.

Course.—The course taken by cases of pyæmic arthritis is very variable, and cannot safely be predicted. Should life be prolonged, the whole of the fluid in the joint may be absorbed, and the articulation may entirely recover. Sometimes, however, considerable stiffness is produced by the development of fibrous adhesions, and frequently the joint is firmly ankylosed. In other instances the joint becomes, often in a few hours, considerably distended, and the seat of obvious fluctuation. The swelling is usually flaccid, rather than firm and tense, the outline of the synovial membrane is distinctly mapped out, and the fluid in the joint conveys the sensation of being near the surface. The skin is either natural in appearance, or presents a faint blush, often limited to some part of the surface. There is in many instances so little pain at first that the condition of the joint may escape notice. As the disease advances the distended capsule gives way, and pus is widely extravasated into the surrounding parts; the ends of the bones, as the result of the destruction of the ligaments, undergo displacement, disorganisation of the joint becomes complete, and in young subjects separation of the epiphyses may occur.

Morbid anatomy.—In post-mortem examinations of the joints in *recent* pyæmia, there is found no material

swelling of the synovial membrane, and the cartilages, ligaments, and the ends of the bones when they have been washed present no abnormal appearance, except occasionally discoloration and staining from blood-pigment. The articular cavity is filled with pus, which is of a distinctly yellow colour, or of a red tint from admixture of blood, and which is thin, flaky, or curdy in consistence, and sometimes very foetid. Should, however, the patient survive for any length of time, destructive changes may be well marked in the structures of the joint.

Treatment.—On the slightest suspicion that acute septic arthritis is about to set in, the joint must be placed in a position of ease on a splint and kept absolutely at rest. The attempt to treat these cases without a splint, by supporting the limb on a pillow, may be confidently expected to end in disaster, for, owing to the considerable effusion which may occur in the less acute cases, and rapid disorganisation in the more severe, there is a strong tendency to displacement of the ends of the bones. In the hip, dislocation on to the dorsum ilii is apt to occur; and in the knee, great deformity from flexion and displacement backwards. Plate 2 illustrates a spontaneous dislocation occurring at the left hip-joint. The patient, a boy, aged 15, was admitted to St. Bartholomew's, under Mr. Bruce Clarke, with acute osteo-myelitis of the tibia. During the illness the dislocation occurred spontaneously and without evidence of suppuration. Moreover, in advanced cases pain becomes severe, especially on movement. It is necessary, therefore, that the limb should be at once supported and kept at rest in good position.

As soon as fluid is detected the joint must be opened by free incisions, and copious irrigation employed. A specimen of the pus should be taken, and



PLATE 2.—SPONTANEOUS DISLOCATION OF THE HIP.

The head of the femur is partially destroyed and displaced on to the dorsum ili.

(From a patient under the care of Mr. Bruce Clarke. Radiogram by Dr. Howard Pirie.)

cultures made so that the nature of the infection may be known. Free drainage should be employed, and the joint irrigated at least every six hours. In the case of the elbow, wrist, or ankle, the limb should be placed in a bath (iodine 1-400) for several hours during the day. In the hip, shoulder, or knee, continuous irrigation may be employed by means of a douche-tin suspended over the bed.

In the case of the knee, if at the time of the operation there is extensive suppuration, more especially if pus should have burrowed into the posterior pouches of the joint, it is advisable not only to drain anteriorly, but also posteriorly behind each condyle, by incisions made on the inside between the tendons of the gracilis and sartorius immediately over the condyle, and on the outside parallel to the biceps tendon just internally to the external popliteal nerve.

If this treatment of incision, drainage, and irrigation is adopted early and is energetically carried out, suppuration is in many cases arrested, the case takes a favourable turn, and recovery may be expected, though with considerable damage to the joint.

Should the case take an unfavourable course, so that the joint has evidently become disorganised, and pus has burrowed widely in the limb, the question of amputation must be considered. The operation should not be postponed if, while the joint is the seat of profuse suppuration, the patient, with a high temperature, and with loss of appetite and sleep, is daily losing flesh and strength. The effect of the amputation is often very marked. There is an immediate improvement in every respect, and convalescence rapidly advances.

Before resorting to amputation in the case of the knee-joint, if the condition of the patient will allow, an attempt may be made to save the leg, by freely laying

open the joint as for excision, or by transverse ⁺division of the patella. The crucial ligaments should be divided and the entire joint flushed, scraped, packed with gauze, and drained both in front and behind, on the chance of recovery with ankylosis.

In some instances, where the arthritis has resulted from puerperal fever or a very severe blood-poisoning, or where the patient is suffering from serious organic disease, the danger of leaving the joint may be less than that incurred by amputation, and the operation must, therefore, not be ventured upon till all the features of the case have been taken into consideration. It may be best to wait, in the hope that an opportunity may occur at a later date for amputation in more favourable circumstances.

Combined with active surgical treatment, passive congestion (*see* p. 57) may be used to increase the exudation of leucocytes and to aid in the destruction of micro-organisms.

In all cases cultures should be taken from the blood, as well as from an infected joint. If in spite of appropriate surgical treatment the case is obviously losing ground, serum- or vaccine-therapy should be tried, though there is not much hope of success in the acute cases;

In streptococcal infections a polyvalent serum should be given, in the hope that among the strains used for the serum there may exist one that corresponds to the infecting organism. Unfortunately it requires some weeks to obtain a serum made from a culture of the particular strain in an individual instance, so that this course can only be adopted in cases of long duration.

It is extremely difficult to estimate the value of serum-inoculation in these cases. If the case recovers after the use of serum, recovery may quite unjustly be attributed to its use, but here and there examples are

met with so striking in the sudden change following on inoculation as to leave no reasonable doubt of its efficacy. These are cases in which, in all probability, the surgeon has been lucky enough to hit off a serum corresponding to the infecting organism. Such occasional successes, though rare, seem to justify the use of serum in patients whose powers of resistance are failing despite prompt surgical treatment.

The treatment by vaccines, already referred to on p. 102, should be tried in all cases of chronic pyæmic infection.

SUBACUTE BLOOD-INFECTIONS (SUBPYÆMIC)

In the class of cases just considered, the arthritis is but a part of a general infection, and frequently may be not a prominent, or at any rate not the predominant, feature in a grave septicæmia.

The cases about to be considered differ widely from those, in that the arthritis is "the disorder," and usually the only secondary manifestation of a primary infection which is often obscure and frequently trivial.

These cases are of extreme importance because of the difficulties and mistakes that often arise in diagnosis, and consequently in treatment.

The general statement may be made that wherever, in any organ, or any part of the body, a septic process exists, joint-infection may result. The part played by the *tonsils* and the *lymphatic tissues of the pharynx* in harbouring organisms by which the joints may be infected has only in recent years been fully appreciated, and the same may be said of the *teeth* and of the *mucous membrane of the mouth*.

A gentleman who had been out of health for several months was attacked with what was regarded as acute rheumatism of the right knee, which suddenly became painful, and considerably enlarged from synovial effusion and infiltration of the surrounding structures. The surface was hot, the skin was a little dusky,

and there was some pitting on pressure. No other joint was involved. It was found that purulent discharge had been going on from the sockets of three of his teeth for at least a year. When the teeth had been removed, and the alveoli scraped and rendered aseptic, the patient's general health considerably improved, and was ultimately completely regained. The joint, however, remained stiff from fibrous ankylosis, and the patella was firmly adherent to the condyles of the femur.

Two cases have been seen in which, after carious teeth were cut down level with the gum and a new crown was applied, on the American system, the patients became subject to what was regarded as acute osteoarthritis, involving several of the large joints, and those also of the hands. Infection being suspected, attention was turned to the teeth, in which, ever since the crowns had been fixed, there had been some discomfort. On investigating their condition, a dental surgeon expressed the opinion that the fangs were probably necrosed. The fangs were therefore removed, when a small amount of pus was found in the sockets.

In both these cases the joint-affection was arrested. In the one the finger-joints remained somewhat enlarged but were otherwise normal, and the large joints regained their full range of movement. In the other, one knee and one ankle were left in a condition of partial fibrous ankylosis and the finger-joints were enlarged and the fingers deflected towards the ulnar side. In another case, a lad of 14 had enlargement and slight stiffness of several finger-joints, and swelling and stiffness of both ankles and one elbow. He was anæmic and pale, but had not been acutely ill. The condition, regarded as chronic rheumatism, had been present for six months, but in varying degrees, sometimes almost disappearing and then becoming more pronounced. On searching for some infective focus it was ascertained that the discharge of a small quantity of pus had been going on intermittently for four months from a pin-

hole opening in the gum opposite the bicuspid teeth of the lower jaw. As the teeth in the neighbourhood of the sinus were all normal in appearance and free from pain, it was uncertain which was at fault. A skiagraph was therefore procured in order to see if any further evidence could be obtained. This showed quite definitely that one fang of the second bicuspid was necrosed and that the alveolus was enlarged into a globular cavity and filled with either pus or granulation-tissue. This tooth was removed, and the alveolus, which contained three or four drops of pus, was scraped out. Improvement of the boy's general health quickly followed, and the joint-affection receded and in three months had practically disappeared.

Many cases have been recorded in which an infective arthritis has been met with in connection with *septic cavities in the lungs*.* In the *Transactions* of the Clinical Society (1902), Dr. Percy Kidd reported the case of a female patient, aged 26, who, eighteen months before, had become the subject of chronic bronchiectasis. Six months later the sputum was copious and very offensive, and the ankle-joints became swollen and stiff. Subsequently the wrists and the knees were involved. When the patient was exhibited the wrists were tender, swollen, and stiff. The fingers were generally enlarged, their joints swollen and painful, and their ends clubbed. The knees were swollen and contained fluid; the ankles, too, were swollen. It was noticed that the condition of the joints varied with that of the bronchiectasis. When this was, as is said of volcanoes, active, and there was expectoration of much foetid pus, the joints were much worse, while they improved when expectoration was smaller in amount and less foetid. The features of this case were so

* Hypertrophic pulmonary osteo-arthritis is discussed in Chapter IX., p. 167.

marked that the connection between the joint-affection and the condition of the lung was readily apparent.

In other instances infective material, whether derived from a pulmonary cavity or an empyema of long standing, may be in such small quantity, that when arthritis makes its appearance its septic nature is overlooked, and it is interpreted as to a mild form of rheumatism.

A boy of 17 had empyema. A portion of rib was removed and a drainage-tube introduced. In two months the opening was nearly closed, and the discharge amounted to only a few drops in the twenty-four hours. This limited discharge of pus continued for six months, when painless swelling and stiffness were noticed in the ankles, one knee, one wrist, and in almost all the finger-joints, and the patient became anæmic and lost flesh. For some months he was treated for rheumatism, and salicylates of sodium, with quinine, were prescribed, but the results were disappointing. Later on he was sent into the country and ordered to take iron in various forms, and arsenic. His condition remained unchanged except that while one of the ankles and the wrist slowly recovered, one shoulder and the joints in the lower part of the cervical spine became affected. When the case was seen three months later, a probe introduced into the sinus passed in a downward direction for about 3 inches. Two inches of the seventh rib were removed, and a cavity defined which was found to contain 3 drachms of odourless pus, in which streptococci were seen under the microscope. This cavity was scraped and drained. Favourable healing took place and was completed in eight weeks. After this the arthritis slowly cleared up, and in twelve months had disappeared, but the spine and the shoulder were still stiff.

Arthritis may be secondary to an *infective process in the skin*.

W. R., aged 54, who had been intemperate and now had diabetes, had a boil on his abdomen near the groin. This was opened, and 2 drachms of foetid pus were let out. Within three days he had very acute inflammation of the right knee-joint, which became flexed, considerably swollen, and globular from periarticular infiltration (there was no fluid in the joint), and intensely painful. The skin was red and shiny, suggesting early suppuration, but none occurred. The patient had a high temperature and was very ill. The knee was treated by rest and

extension. Slow improvement occurred, and in three months the patient was able to be up on crutches. Ankylosis, however, followed. No other joints were involved.

A boy of 18 had a quite superficial excoriation of the skin over the middle of the tibia, the result of a fall on a gravel path. This youth was so careless and neglectful that he neither mentioned the injury nor took any care to keep the surface clean. A fortnight later he was attacked with "rheumatism" in his left knee and ankle, and had a temperature of 102° . The wound in the leg was dirty, and the leg of his drawers was sticking to the exposed surface over an area about an inch square. In the next fortnight his right shoulder and wrist and several finger-joints became stiff, swollen, and painful, but all ultimately recovered except the knee, which remained stiff from adhesions. Movement, however, was restored to nearly the full extent by manipulation under chloroform, and hot-douching and massage.

Infective arthritis may be secondary to *vaginal discharge* (other than gonorrhœa), and to septic conditions within the uterus. This sequence of events is probably more common than is usually supposed, and not a few cases which have been regarded as rheumatism or tuberculosis have been due to absorption from a septic vaginal or uterine mucous membrane.

A lady, aged 29, had a miscarriage, followed by a brown, foetid discharge. Six months later her left knee became swollen and painful. At first the affection was thought to be rheumatic, and salicylates were prescribed. But when no improvement followed, and when the synovial membrane became more and more infiltrated and thickened, the condition was regarded as tuberculous, and rest in a splint was ordered. When I first saw the knee the appearances of the joint were in every respect similar to those commonly met with in advanced tuberculosis, yet they were also such as might be due to sepsis. During the interview it transpired that the patient was under the care of a gynaecologist, who had recommended, as the discharge still continued, that the uterus should be curetted. I was glad to hear of this, for it seemed likely that the proceeding might have a very advantageous effect on the knee. This anticipation was fulfilled. Two months after the operation was carried out a marked improvement had taken place, and in six months the joint, after passive movements, douching, and massage, recovered.

It is enough simply to mention cases of septic arthritis *following parturition*, which were formerly regarded as examples of acute rheumatic arthritis, and in which patients became anæmic and debilitated, and had raised temperature and multiple arthritis, involving several of the large joints and those of the fingers. The nature of such cases is now generally recognized.

Concerning arthritis which is produced by absorption from *the surface of the intestine*, nothing conclusive is at present known beyond the fact that infection by the *Bacillus coli communis* has been observed.

In a female of 28, chronic cystitis, which had been followed by arthritis, was found to depend on the presence of this bacillus. When the cystitis was removed by treatment, the arthritis slowly disappeared.

Diagnosis and prognosis.—When arthritis occurs in the circumstances described, it takes the form of a plastic inflammation attended with the development of adhesions leading to a varying degree of fibrous ankylosis. Usually effusion into the synovial cavity is limited: it seldom amounts to more than 3 or 4 ounces; often it is entirely absent. The subsynovial tissue and the periarticular structures are infiltrated, considerably thickened, firm, inelastic, and brawny, so that the joint is enlarged from uniform swelling. When the knee is affected, thickening may extend to the periosteum and adjacent structures investing the lower end of the femur, and the bone may feel enlarged for 4 or 5 inches above the condyles. The skin covering the joint, in severe cases, is dusky red, as if suppuration were imminent; but generally its appearance is unaltered. Pain is very variable in degree. In acute cases it is severe and persistent, difficult to relieve, and aggravated to intensity on any disturbance of the joint. In the case of W. R.—(p. 134) the patient was in great suffering for three weeks, in spite of complete rest of the joint in a carefully

adjusted splint. In mild cases pain is slight, or even entirely absent. In some it is present only when the joint is moved; in other words, it corresponds (except in its most severe degree) with that which attends the usual run of tuberculous cases. In acute cases reflex irritation leads to a high degree of muscular spasm and a tendency—in the knee—to flexion, which it may, subsequently, be difficult, or, I may add, impossible, on account of adhesions, to remove. In slight cases spasm is practically absent. Muscular wasting always supervenes, but varies widely in amount. When it is marked and is associated with persistent swelling of a joint it readily misleads the unwary, as it exactly corresponds with what is observed in tuberculous disease. The body temperature is usually between 99° and 101° F.; in mild and prolonged cases it may be normal. Suppuration seldom occurs in these cases, even in those which are most acute and attended with severe and persistent pain, and with a dusky tint and, as is occasionally to be observed, some œdema and pitting of the surface.

In acute cases the result to be expected—for it is almost inevitable—is firm and complete fibrous ankylosis. This may occur in the course of six weeks. Indeed, the rapidity with which such an abundance of inflammatory material may be developed into new fibrous tissue, so that the joint is completely effaced and replaced by a cicatrix, has often been a matter of surprise.

Treatment.—As an obvious preliminary, every effort must be made to find out the source of infection.

In many instances this is at once indicated by a discharge of pus from a sinus in connection with a long-standing empyema, or when there is bronchiectasis with purulent expectoration, a foetid ozæna, or suppuration

connected with the mouth. In female patients a vaginal or uterine discharge must not be overlooked.

Unless it is remembered that a very limited amount of septic material may produce infection, the presence of some chronic and scanty discharge may be thought too insignificant to deserve attention. And further, it must be borne in mind that the amount of discharge coming from a sinus of long standing is by no means a trustworthy indication of the condition of things at the deep end of the passage. Every surgeon of experience will agree that a sinus in the lower part of the thigh, although it has only a pin-hole external orifice and gives issue to but a few drops of thin pus in the twenty-four hours, and even although it appears, every now and then, to have finally closed, may yet lead down to an extensive necrosis of the femur, and a large sequestrum lying in a bed of granulation-tissue pervaded by infective bacteria. In such a case the staphylococcus or streptococcus, whichever it is, although it has become less and less virulent by prolonged growth in a soil tending to become exhausted, may yet, by maintaining a continuous though limited supply of infective material, lead to the low-grade arthritis just described. Every surgeon also will agree that a small sinus in the heel may communicate with the os calcis, whose cancellous interior has been extensively destroyed by tuberculous disease and replaced by septic granulation-tissue. The fact that in conditions such as these infection is very rare must not be allowed to obscure the possibility of its occurrence. The important point is that whenever any source of infection—however limited it may appear to be—can be detected, means should at once be adopted to cut it off, and to this end treatment must be thoroughly and persistently carried out. There is, however, a serious difficulty which may present itself, namely, that in a case which there are good clinical grounds

he calls
the open
sinus.

for regarding as one of infective arthritis, there is nothing to show where the infection has originated. In such circumstances the condition of the intestinal canal must be suspected, and if there are any signs of an unhealthy state of the secretions, corrective measures must be adopted. When once the source of infection has been removed the joint-condition will improve, but at different rates of progress in different instances. In obstinate cases, vaccines prepared from the infecting organism should be employed.

In considering the line of treatment which should be adopted, the life-history of the bacteria concerned must be remembered. This in the case of streptococci and staphylococci is widely different from that of the *Bacillus tuberculosis*. A chief characteristic of the tubercle bacillus is its prolonged vitality and the manner in which it is able to resist destruction by phagocytes and kindred agencies. The other bacteria just mentioned are much more easily eliminated. Although the streptococcus may be present in large numbers in cases of diffuse suppuration or acute abscess, it may, by incisions and drainage, disinfection and phagocytosis, be got rid of in the course of a few days. After this the tissues, freed from infection, are in a condition to undergo repair; and the object of treatment is limited to the removal of such symptoms as remain and the repair of damage which the process of infection, now at an end, has brought about. Thus the necessity, in relation to treatment, of distinguishing between tuberculous disease and infection by the gonococcus or streptococcus becomes obvious. If arthritis is tuberculous the joint must be kept for many months at complete rest, and the patient must, if possible, be treated on the open-air system, while in the other group the purpose of treatment, when the supply of infective material has been cut off, will be the removal of coagulable lymph, the

separation of adhesions, the restoration of movement, and the repair of atrophied muscles. These several results are best attained by hot-douching, massage, and often by manipulation under an anæsthetic.

to tremble
Douching should be employed morning and evening, at the highest temperature that can be borne without discomfort. A series of small blisters is often very useful. So are hot-air baths. Manipulation to overcome stiffness in slight cases may be carried on without an anæsthetic, and should be combined with voluntary efforts on the part of the patient:

In suitable cases—those, namely, in which the joint is cool and painless, but yet stiff—manipulation should be the first step. It will be well borne, and followed by quite moderate swelling and heat, which will subside in a few days. After it the other treatment referred to will act with much more marked effect. In employing manipulation, however, there is one point which must always be kept in view. The inflammatory process is often of such a plastic character—although the symptoms are of only moderate severity—that complete fibrous ankylosis may occur, stealthily as it were, in the course of six or seven weeks, or in a still shorter time. Indeed, the formation of new tissue may be so active as to remind us of what is seen in the repair of fractures, the period occupied in the production of ankylosis being one of weeks, not months.

Hence it may be found on manipulation under an anæsthetic that the joint is so fixed that it does not yield to anything short of considerable force. This will be conclusive evidence that the joint has been obliterated, and replaced by cicatricial tissue. In such a case all hope of restoring movement must be abandoned; for although, by the use of more force, it may be possible to tear the cicatrix across and so produce movement at the time, the cicatrix will inevitably re-form, probably

over a wider area than before, and stiffness will return; and the damage done will be followed by a period of much suffering lasting several weeks, and by thickening and brawny swelling extending over many months.

In cases in which it is found on manipulation that firm fibrous ankylosis has occurred, it may yet be advisable to employ force enough to rupture the union. This is the case when the joint has become fixed at an unfavourable angle, when, for instance, the foot forms an angle of 120° with the leg, so that the heel cannot be brought down. When it is the knee which is ankylosed in a bad position and cannot be moved without considerable force, excision, in patients between 15 and 45, had better be performed. This will secure, at practically no risk in the hands of a competent operator, a straight and sound limb with less than an inch of shortening, and ready for active use within two months; whereas manipulation may fail to correct the position of the limb, and be followed by repeated and disabling inflammatory attacks, and by recurrence of deformity.

In cases in which the adhesions easily give way under manipulation it may be necessary to repeat this proceeding once or more at intervals of a fortnight—if stiffness is threatening to recur—so that the reunion of adhesions may be prevented and their absorption promoted. The latter is a point on which a word may be said. The absorption of superfluous callus as the last stage in the repair of fractures is a process with which all are familiar. That adhesions may also be completely removed is sometimes overlooked, with the result that manipulation and exercises are not used with sufficient perseverance, and limitation of movement, which might have been removed, is allowed to remain.

An officer in South Africa was shot transversely

through the posterior segment of the knee-joint. Primary union occurred, but the joint became stiff in a position of flexion, and the patient was invalided home. When he was examined under an anæsthetic, while the patella was movable the adhesions between the femur and tibia were so firm that they gave way only when the attempt to separate them had been carried to the full degree which seemed advisable. Manipulation under an anæsthetic was repeated twice in the course of the next month, and then the joint could be moved through an angle of 40° . Daily movements of the joint by means of a weight and pulley were ordered. In the course of a few months movement gradually increased, until no defect remained except a slight limitation of flexion. In this instance, which may be regarded as representative of many others, extensive adhesions were removed as completely as peritoneal adhesions often are after tuberculous and other forms of peritonitis.

CHAPTER IX

ARTHRITIS DEFORMANS

Nomenclature.—The disease now to be described has received a large variety of confusing and contradictory names. Many of these are, happily, becoming obsolete, and are now seldom employed in the monographs and text-books on the subject. They are, however, still current in the phraseology of every-day practice, and it is therefore desirable, in order to avoid ambiguity, that they should all be enumerated here. The old writers styled the affection rheumatic gout; Haygarth, nodosity of the joints; Robert Adams, chronic rheumatic arthritis; Garrod, rheumatoid arthritis; Spender, osteoarthritis. The French term it *arthrite sèche*, or, after Cruveilhier, *usure des cartilages articulaires*; the Germans, arthritis deformans. So large an assortment of titles suggests that much doubt has existed as to the real nature of the affection. This is, in fact, the case; and it is becoming increasingly evident that several fundamentally dissimilar conditions are comprised under these terms.

In any attempt at classification of the various conditions included under these headings, it must be remembered that, as in other parts of the body, so also in the case of the joints, the same symptoms and the same pathological appearance may be caused by diseases that are essentially different from one another; and that one "disease," according to our present-day idea of what is meant by a disease—for instance, the results of the invasion of the body by a particular micro-organism—

may cause a variety of symptoms and of pathological appearances. Thus we know that the gonococcus may at different times or in different individuals cause (1) simple synovitis, (2) hydrops, (3) fibroplastic inflammation, (4) empyema, etc.; whilst, on the other hand, many different organisms are capable of causing any one of these.

Investigation has led to the classification into independent groups of the disorders once ranged under the name of rheumatism, and a similar policy will also be called for in dealing with the conditions hitherto classed under the term osteo-arthritis, and its synonyms. It has been pointed out by various writers that the anatomical changes which have been ascribed to arthritis deformans may be found in joint-affections associated with conditions so dissimilar as gonorrhœa (Chapter VI.), scarlet and other specific fevers (Chapter VII.), hæmophilia (Chapter XIV.), hypertrophic osteo-arthropathy (p. 167) and discases of the nervous system (Chapters XII. and XIII.). Further subdivision along these lines will certainly occur in the near future, and the names hitherto employed will either fall into disuse or become more restricted in their meanings. For the present, some general heading being obviously necessary, arthritis deformans is here selected as, on the whole, the most convenient. It involves no pathological theory, while at the same time it serves to suggest the most obvious and constant features that are met with in the different forms of the disease in question.

Clinical classification.—Whatever may be the case from the pathological standpoint—and this is a matter about which there is still much difference of opinion—there is no doubt that, clinically, cases of arthritis deformans fall naturally into two main classes—the synovial (rheumatoid arthritis) and the bony (osteo-arthritis). Although the former may affect only one

joint at first, and may remain confined thereto, even for some considerable period, yet commonly it affects several. When this takes place, as is usually the case in the long run, the two sides of the body will be found to be more or less symmetrically involved, and sometimes very conspicuously so. The bony form, on the other hand, though it may exceptionally be generalised, is more frequently monarticular, and when several joints are affected the distribution is often unsymmetrical.

*Symmetrical.**Bony*

For the onset of rheumatoid arthritis no cause can, as a rule, be assigned, whereas osteo-arthritis is especially apt to occur in a joint which has been previously damaged by injury or disease.

RHEUMATOID ARTHRITIS

It would be beyond the scope of this book, and would be trespassing on the domain of the physician, to attempt to deal exhaustively with this branch of the subject. In the last chapter, under the heading of Septic Arthritis, are included cases which some writers would describe under the generic term rheumatoid arthritis. It seems, however, advisable to restrict the meaning of the term rheumatoid arthritis, and to employ it to denote cases clinically distinct from those already discussed under the designations infective and septic arthritis on the one hand, and from osteo-arthritis on the other. With a view of differentiating rheumatoid arthritis from the more or less allied forms of arthritis which will be described under the name of osteo-arthritis, it will be convenient to refer briefly to the symptoms and clinical course of the former.

Symptoms and clinical course.—The term rheumatoid arthritis should be reserved for those cases of arthritis deformans in which the stress of the disease falls on the synovial membrane and periarticular tissues. It is commonly met with in women between the ages of

twenty and forty. It is, however, occasionally seen in quite young children, and, though this is rare, may commence even in old age. There is usually a fusiform enlargement of many joints, those most commonly affected being the proximal interphalangeal, the metacarpo-phalangeal, the wrist-, radio-ulnar, knee-, shoulder-, temporo-mandibular, tarsal, and spinal joints. The hips are comparatively rarely affected. The fluid present in the joints is usually moderate in amount, though where a large joint is involved it may be considerable. It is clear, viscid, and of a yellow or greenish colour. As the disease advances, synovial fringes form (villous arthritis). The cartilages become involved, and are first affected at the periphery, and not in the centre, as in the degenerative osteo-arthritis forms of arthritis. No slipping occurs at the articular margins, and no osteophytes are formed, though not infrequently the ends of the bones are thinned and, when the articular cartilage is completely destroyed—as not seldom happens in the smaller joints—are rough and irregular. As a rule, the disease begins in the smaller joints, especially the proximal interphalangeal, the metacarpo-phalangeal, and the wrists. Not infrequently it starts in one knee. Every grade of acuteness may be seen. Muscular wasting is often rapid and extreme, and may even precede any very obvious joint-changes; muscular spasms occur, and the deep reflexes are increased. Both pain and rigidity are very variable; sometimes they are completely absent. But deformities from contracture are the rule. It may be said that the pain is of three distinct varieties—the joint-pain proper, severe neuralgic pains, and painful muscular cramps. In some cases, even when the capsules of the joints are acutely distended, no pain, but only stiffness, is complained of; in others, the pain is excruciating. Other sensory disturbances sometimes precede or accompany the

joint-changes, such as tingling, numbness, and pins-and-needles in the hands and feet. Vaso-motor changes are common: cold, dead fingers; glossy fingers; and cold, sweating palms. Pigmentations of the skin are a marked feature in some cases. Some degree of anæmia, with hæmic cardiac murmurs, is usual, and the pulse is increased in frequency. The name of Dr. Still is properly associated with the fact that marked enlargement of the lymph-glands and spleen is generally present in the earlier stages of the disease in children. A similar, though less conspicuous, enlargement of the lymphatic glands * (especially the axillary) usually occurs in adults, and, in exceptional cases, may be accompanied by the splenic hypertrophy which is the rule in the young.

The disease, as it affects individual joints, tends to run a definite course. The initial stage is marked by synovial swelling with effusion, accompanied, in acute cases, by increased local heat, pain, and rise of body-temperature. This is followed by a stage in which the fluid becomes absorbed and the ligaments are softened, the acute or subacute symptoms subsiding into a chronic condition. When the fluid has been absorbed and the ligaments have undergone softening, a curious and characteristic sensation may be produced at the metacarpophalangeal joints when the ends of the bones are rubbed together, as if the opposing surfaces were composed of wet wash-leather. When the cartilages are definitely destroyed, bony grating is always easily elicited and should be sought at the radio-ulnar and metacarpophalangeal joints.

The final stage is one of much deformity, with abolition or great impairment of movement in the joints. Bony ankylosis is said to occur seldom, if ever, but clinically it is by no means rare to find joints—for instance, the wrists—so rigid that it is difficult to

* Waterhouse, *St. Bartholomew's Hosp. Repts.*, 1907.

believe that their component parts are not united by bone. The deformities are usually the result of muscular spasm followed by atrophy and contraction of all the soft parts, including the skin. In this way various distortions of the fingers are produced, the most common being a deflection to the ulnar side with flexion; but by hyperextension at some joints, and flexion at others, most irregular figures may be produced. Although the deformity is great, movement, in this final stage, within a greatly limited range, is smooth and free.

In acute cases, when all the joints are simultaneously affected, this pitiable condition may be reached in a few months, and though the disease has, as it were, burnt itself out, the patient may be left an emaciated, gnarled, and helpless cripple. (Fig. 14.) The jaw may be so fixed as to cause great difficulty in feeding, the fingers so distorted as to be useless, the wrists rigid, the knees and elbows acutely flexed, the feet flattened, and the spine completely rigid. In less acute cases the disease progresses slowly and insidiously, with quiescent periods followed by relapses, to this deplorable termination. Happily, however, this is not always the case, for treatment may not only arrest the disease, but may also mitigate its effects.

OSTEO-ARTHRITIS

Morbid anatomy.—The disease may begin either in the synovial membrane, or in the cartilage: as a very general rule, it begins in the latter structure.

The cartilage.—This to the naked eye becomes rough and uneven, and here and there eroded and worn down, and its surface presents a tufted or fibrillated appearance, resembling the pile of coarse velvet. (Fig. 15.) In parts not exposed to pressure, and especially at its margins, the cartilage undergoes hypertrophy, and becomes heaped up in irregular nodules or ecchondroses,



Fig. 14.—Rheumatoid arthritis.
(*Dr. Waterhouse's case.*)



Fig. 15.—Fibrillation of the cartilage of the patella in a case of osteo-arthritis.

(From a specimen, No. 594, in St. Bartholomew's Hosp. Mus.)

which subsequently undergo ossification or calcification, and thus render the articular borders prominent and "lipped." (Fig. 16.) Sometimes these nodular masses are broken off so as to form "loose bodies" in the joint. (Chapter XVIII.) As the disease advances, the cartilage in many places, but chiefly where it is most exposed to pressure and friction, is worn away, often with the formation

of deep parallel furrows and intervening ridges (Fig. 17), while what remains is mainly broken up into a shreddy fibrous structure, intermixed with

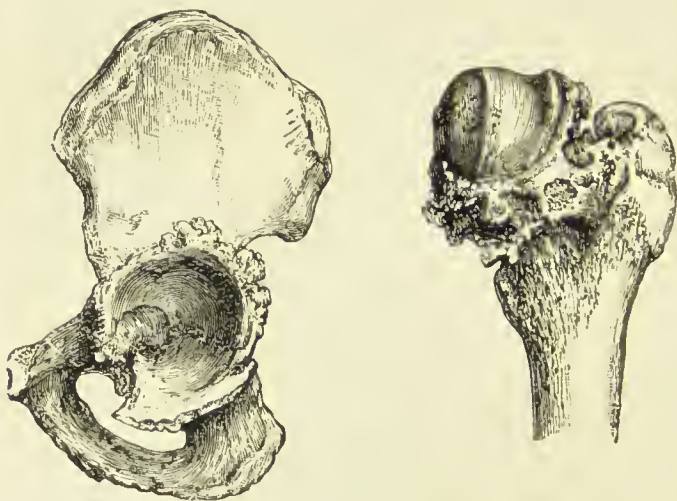


Fig. 16.—Osteo-arthritis of the hip-joint.

(From a specimen, No. 681, in St. Bartholomew's Hosp. Mus.)

patches of calcarous degeneration. Microscopically

examined, in a section made at a right angle to the free surface, the cartilage cells are found to be arranged in vertical columns (Fig. 18), and to be

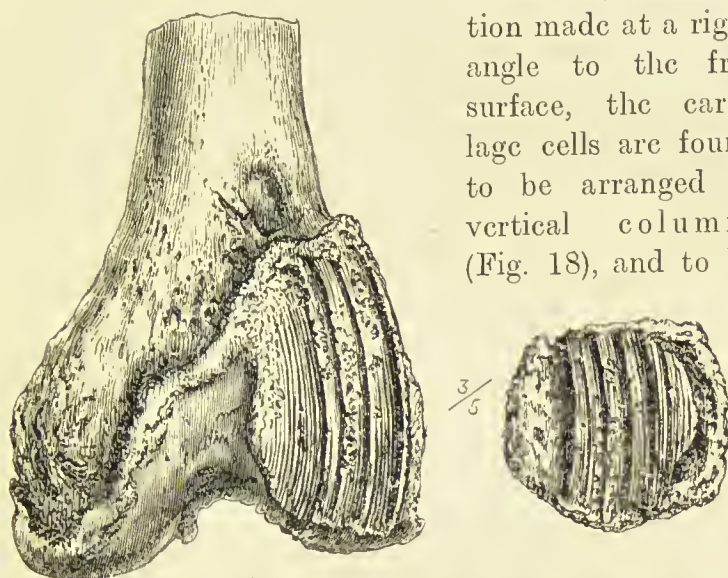


Fig. 17.—Grooving of the cartilages of the femur and patella in osteo-arthritis.

(From a specimen, No. 698, in St. Bartholomew's Hosp. Mus.)

undergoing proliferation, so that the capsules in which they are enclosed become distended. The cartilage capsules thus arranged in a linear series open one into another by a simple process of absorption. The capsules nearest the surface open into the cavity of the joint, the cartilage cells escape, the matrix between the cells remains in part to form the longitudinal striæ and



Fig. 18.—Fibrillation of cartilage in osteo-arthritis.

delicate fibrillated tufts already mentioned, whilst in part it undergoes mucoid degeneration. The degenerated matrix, unable to resist pressure and attrition, is worn away by the movements of the joint; and as this process of fibrillation and wearing down is repeated, the whole thickness of the cartilage is gradually destroyed. At the periphery, where the eechondroses are found, and

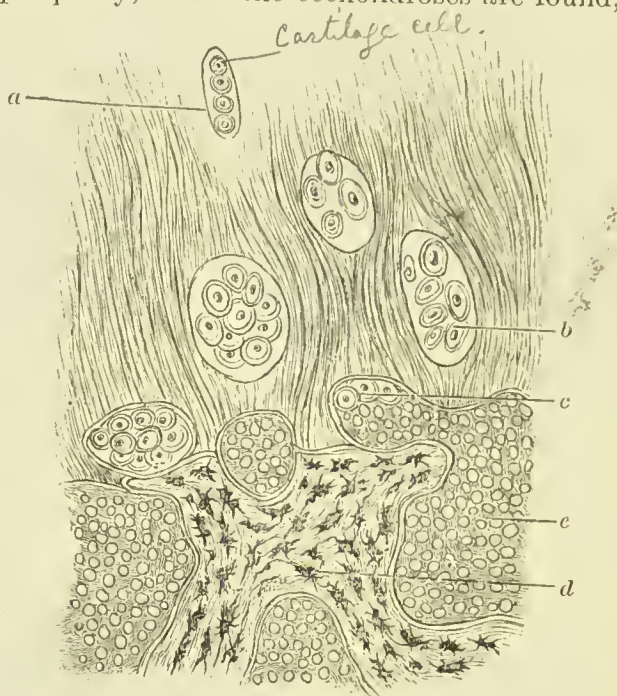


Fig. 19.—Cartilage in osteo-arthritis. (After Cornil and Ranvier.)

a, Normal capsule; *b*, mother-capsule containing secondary capsule; *c*, capsule emptying itself into a medullary space; *d*, newly formed bone; *e*, embryonic medulla, $\times 300$ diam.

the articular borders become “lipped,” the same proliferation of the cells (Fig. 19) and fibrillation of the matrix ensue, but as the edge of the cartilage is covered by a prolongation of the synovial membrane, the cells, instead of escaping, are retained, and undergo multiplication in the subsynovial tissue, so as to form cartilaginous outgrowths, which subsequently become calcified.

The *synovial membrane* becomes slightly increased in vascularity, thickened, and indurated, and, as the result of hypertrophy of its fringes, and enlargement and subdivision of its villi, thickly set with shaggy and tufted elongated or club-shaped processes (Fig. 13, p. 90). The connective-tissue cells of the villi are proliferated and, as Hoffa has pointed out, are here frequently pigmented, probably as the result of past injury with hæmorrhage. As a further change, the cartilage cells (which, as pointed out by Rainey and Kölliker, the villi naturally contain) undergo hypertrophy, and are developed into cartilaginous nodules, varying from a mere speck to masses as large, in some cases, as a walnut. These, when accidentally detached, constitute one of the varieties of "loose bodies." As the affection advances to its later stages, the synovial membrane is, to a great extent, destroyed by mucous and hyaline degeneration. Some effusion of synovia, rendered cloudy, or even milky, by an admixture of disintegrated cartilage-cells, usually takes place into the cavity of the joint in the early stage of the disease, but in the majority of cases it is very limited in amount and of viscid consistence. In some instances, however, fluid is from the first considerable, and may be subsequently much increased in amount.

The *bones* undergo a remarkable change, largely accounting for the peculiar features observed in this disease. As fibrillation and destruction of the encrusting cartilage proceed, and as the ends of the bones become exposed, the articular lamella is reached. Subject to friction, and the seat of a low form of inflammatory action, this structure is, on the one hand, slowly worn away, while, on the other, it undergoes condensation and induration, with the result that its surface is rendered dense and polished, or, as it is termed, eburnated or porcellaneous, and studded with minute circular

holes, as if worm-eaten, an appearance due to the fact that as the bone has been rubbed down the orifices of the Haversian canals have become exposed. Beneath this porcellanous layer, the cancellous tissue, involved in the chronic inflammatory action, undergoes a peculiar change, in which rarefaction and atrophy are combined with new bone-formation and the production of osteophytes, and nodular or tuberos deposits, with the result that, where pressure exists, the articular ends become gradually flattened and worn away; while about the margins, and at such other parts as are free from pressure, large irregular plates and processes are developed. Thus, e.g., in the hip-joint, the convex head of the femur is absorbed, while its borders are surrounded by mushroom-like excrescences of new bone encroaching upon and overhanging the neck, or by thinner plates which partially ensheath it. On the other hand, the acetabulum is considerably enlarged, in a direction upwards and backwards, and rendered deep and oval, while its borders are walled in by large staphylogenic formations and irregular plates. This remarkable process (in which waste and reproduction far exceeding healthy limits are combined) gradually leads to the complete destruction of the articulation, and to the accumulation of new material around it. By these means movement is more and more interfered with, and the limb is rendered more and more weak, stiff, and crippled.

The changes in the *ligaments* and *adjacent tendons* contribute largely to this result. In the knee, for example, the crucial as well as the external and internal lateral ligaments may entirely disappear, so that the joint is rendered "loose," and so weak and flail-like that it may even undergo complete spontaneous dislocation.

In the later stages the *periarticular tissues* also are sometimes the seat of chronic oedema, which may even

extend into the neighbouring parts of the limb. Thus for some distance up the forearm, for example, when the wrist is affected, the skin becomes infiltrated, pale, smooth, and shining, and is tightly drawn over the prominences of the joint; often, again, there is effusion into the sheaths of the adjacent tendons, giving rise to multiloeular gangliform swellings. The absorption of tendons is best illustrated in the case of the shoulder, where that part of the long tendon of the biceps which lies within the capsule of the joint is often found displaced from its groove and frayed out, or completely worn through, and its two ends, separated by a considerable interval, are adherent to the subjacent bone; while the tendons inserted into the tuberosities of the humerus—those of the subscapularis, supraspinatus, infraspinatus, and teres minor muscles—may completely disappear. Ossification of the tendon of the long head of the triceps (which arises just below the glenoid cavity of the scapula), and of the tendon of the ilio-psoas, in the neighbourhood of the hip-joint, may sometimes be observed. Interstitial atrophy and diminished strength of the articular extremities of the bones are illustrated by the fact that the neck of the femur sometimes yields under the weight of the body until it forms less than a right angle with the shaft. Usually, however, this change of shape is produced in another manner. The upper part of the head, where it presses against the upper part of the acetabulum, is absorbed; the neck is partly absorbed also. While these changes are in progress, new bone is formed on the under-surface of the neck and under the remains of the head (these parts being free from pressure), so that the angle between the neck and the shaft is considerably reduced. The production of loose bodies in the joints, resulting from the detachment either of cartilaginous nodules from the synovial fringes, or of osteo-

phytes from the articular margins in osteo-arthritis, is alluded to at p. 257 *et seq.* A pendulous ecchondrosis attached to the intercondylar notch is shown in Fig. 20.

Two important and noteworthy points respecting



Fig. 20.—Osteo-arthritis of the knee-joint. There is considerable lipping of the bones, and the articular cartilage has almost disappeared from the patella and the internal condyle of the femur. In the intercondylar notch is a pendulous ecchondrosis with a narrow stalk.

(From a specimen, 692B, in St. Bartholomew's Hosp. Mus.)

the pathology of osteo-arthritis are, first, that suppuration, even if it ever occurs, is rare in the highest degree ; and, second, that although movement may be entirely

lost, so that the joint is fixed, this loss of movement does not depend upon true ankylosis, which appears never to take place, the process of wearing down and loss of substance not favouring such a result, but upon the locking of the articulation by alteration in the outline of the surfaces of the component bones, the accumulation of new bone around the joint, and the wasted and contracted condition of the surrounding muscles. (See p. 552 in connection with bony ankylosis of the spine.)

Cases are occasionally met with, chiefly in the knee, in which the fluid accumulated in the interior of the joint—fluid consisting of synovia rendered turbid by cell exudation and molecular débris resulting from disintegration of the cartilage and other articular structures—travels towards the surface, and there forms an opening through which it escapes, and from which it subsequently continues to drain away, sometimes for several weeks. Though the cavity of the joint is thus opened, no active inflammation may follow, the tissues having apparently acquired immunity from bacterial infection. A man, aged 52, was in St. Bartholomew's Hospital in 1883 with osteo-arthritis of the right knee of some years' duration. The articular ends of the bones were enlarged and uneven. The joint-cavity was considerably enlarged, and the synovial membrane was thickened and indurated, and here and there presented nodular masses of cartilage readily felt on palpation. On the outer side above the patella was an opening, through which an ordinary-sized cedar pencil might be passed, and from which turbid synovia, varying in quantity from a few drops to two or three teaspoonfuls a day, constantly drained away. The joint, in which creaking and grating were felt, could be moved through an arc of three or four degrees without causing pain. The patient said that the discharge had been going on

for six weeks, and that at first it was much more profuse. His temperature was normal, and he had little pain. The left knee presented well-marked evidences of osteo-arthritis, though only in an incipient stage.

Etiology.—It will be seen from the above description of the morbid changes met with in this form of arthritis, that, whatever the primary pathological factor may be, the result is a degeneration of all the component parts of the joint. That this degeneration follows on a chronic inflammation of low-grade intensity admits of little doubt. The part which *injury* plays in determining the deposition of tubercle in a joint is well recognised; the part which it plays in osteo-arthritis is less generally recognised, yet is equally important. The changes which are met with in the knee-joints of quite young subjects after severe injury resulting in internal derangement are, in cases of long standing, closely similar to those met with in osteo-arthritis. When a semilunar cartilage becomes detached or displaced it acts as a constant source of irritation, and, if allowed to remain, gives rise, sooner or later, to a chronic inflammation of the cartilage and synovial membrane, which to the naked eye is indistinguishable from the changes seen in the early stages of osteo-arthritis.

This form of traumatic arthritis may, indeed, result from a hæmorrhage into the joint, apart from any gross injury to its structure. A foreign body, whether it be blood-clot or a torn cartilage, must act as an irritant and produce chronic inflammation followed by hypertrophy. From this to the more advanced stage of attrition of cartilage and bone is an easy step, given certain predisposing factors. That the so-called traumatic arthritis in young subjects does not reach this advanced stage may be explained either by the response of young tissues to treatment—rest to the damaged joint-surfaces and stimulation of the circulation by massage—or, in

untreated cases, by the absence of those predisposing factors which aid and abet the degenerative changes.

Injury may not be the only exciting factor. *Cold* and *exposure*, leading to congestion, may, in the cold, be sufficient to start a chronic inflammation, readily followed by degenerative changes in the presence of arteriosclerosis or disease of the nervous system.

Typical osteo-arthritic changes are met with in the joints in *hæmophilia*, following on repeated hæmorrhages into the joint-cavity. (Chapter XIV.) Two factors come into play—the damage to the joint from intra-articular hæmorrhage, and a predisposing factor—vascular disease.

Osteo-arthritis is most commonly met with in those past middle age, whose arteries are frequently degenerate; and it is reasonable to suppose that in these subjects degenerative changes would occur when once the balance of nutrition had been disturbed in a damaged joint. Hoffa and Wollenberg* have observed typical endarteritis obliterans in the vessels of the synovial membrane in a case of osteo-arthritis.

Many other predisposing factors may contribute—e.g. *changes in the central nervous system*. As will be seen later in the discussion of the neuropathic arthropathies (Charcot's Diseases and Syringomyelia), the changes met with are very similar to those of osteo-arthritis, though the trophic changes, as might be expected, advance more rapidly and end in far greater destruction of bone.

Osteo-arthritis may follow an attack of *infective arthritis*. In joints that have been affected by gonorrhœa, for instance, it is not at all uncommon to find lip-ping of the ends of the bones, etc. The determining factor is, here, the damaged joint, and not the infective agent. Though we cannot exclude an infective or toxic origin of osteo-arthritis, especially when it occurs in

* Hoffa and Wollenberg, "Arthritis Deformans," 1908.

young subjects, yet the balance of evidence, both clinical and pathological, is opposed, in the majority of cases, to any infective origin.

Doubtless *disorder of metabolism* may predispose to osteo-arthritis. Apart from the deposit of biurate of soda, some of the changes met with in the joints in chronic gout and osteo-arthritis bear a close resemblance to one another (Chapter XI., p. 186), and in some instances typical osteo-arthritis occurs in patients who are the subjects of gout. The part played by the internal secretory glands in the general metabolism of the body is daily attracting more attention. That they influence the growth and nutrition of the skeleton we have evidence in the association of acromegaly with pituitary disease, and cretinism with athyroidism. Osteo-arthritis, more especially of the knees, is not infrequently met with in women at or about the menopause, at a time when athyroidic or subthyroidic symptoms—e.g. dry skin and slight degrees of myxœdema—are not uncommon. The fact that trophic joint-changes coincide so frequently with grave disturbance of ovarian and, it may be, thyroid activity, is, at any rate, suggestive of a causal relationship.

Diagnosis of osteo-arthritis from rheumatoid arthritis.—As already stated, osteo-arthritis must be regarded as quite distinct from rheumatoid arthritis, even though border-line cases are sometimes met with, which present some features common to both diseases. Osteo-arthritis, on the one hand, is a disease which confines itself to the joints—frequently to only one joint, and that a large one. Constitutional symptoms play no special part in its clinical course. Rheumatoid arthritis, on the other hand, is a disease which, affecting many joints, does not confine itself to the joints, but is associated not only with marked atrophy of muscles, but with general constitutional symptoms (pp. 146–47).

In osteo-arthritis the stress of the disease falls on the cartilage and bones; in rheumatoid arthritis, on the synovial membrane and periarticular tissues. In the former, fluid effusion is frequently absent (*arthrite sèche*); in the latter it is the rule.

Osteo-arthritis is, in the main, a disease of middle age or advanced life; rheumatoid arthritis, of early adult life.

When osteo-arthritis attacks the small joints it has a predilection for the terminal phalangeal joints (Heberden's nodes), and seldom attacks the proximal interphalangeal joints. When a single joint is attacked, the hip most often suffers. Rheumatoid arthritis usually commences in the small joints and spreads centripetally. It commonly involves the proximal interphalangeal joints, and seldom the terminal joints. Unlike osteo-arthritis, it rarely involves the hip-joint.

The deformities which follow osteo-arthritis result from changes in the outlines of the end of the bones. Those which follow rheumatoid arthritis result from muscular spasm and atrophy.

Osteo-arthritis is seldom acute in its onset, and it runs a chronic course; rheumatoid arthritis, though in the majority of cases commencing insidiously, is often acute in onset and may run a rapid course.

As Garrod has pointed out, there is no more resemblance between the clinical pictures of osteo-arthritis and rheumatoid arthritis than between chronic interstitial and acute parenchymatous nephritis. It is true that, as in the later stages of a parenchymatous nephritis, sclerotic changes may occur and give rise to the symptoms of an interstitial nephritis, so it may occasionally happen that osteo-arthritic changes may be grafted on a chronic rheumatoid joint; yet the end-product of rheumatoid arthritis is not osteo-arthritis any more than granular kidney is a natural sequel to parenchy-

matous nephritis. The analogy may perhaps be carried still further. There is strong presumptive evidence that acute rheumatoid arthritis is infective in origin, as we know is the case with acute parenchymatous nephritis, and there is much to support the view that osteo-arthritis is profoundly influenced, if not caused, by vascular degeneration, as we know is the case with granular kidney. Like rheumatoid arthritis, acute nephritis is prone to attack the young, while interstitial nephritis and osteo-arthritis are commonly met with in those past the meridian of life.

Osteo-arthritis, as it affects individual joints, is described under the headings of Diseases of the Hip, Knee, Wrist, etc. (Chapters XXIII.-XXX.). No sharp line of distinction can be drawn between the generalised form affecting several joints and the monarticular form which affects a single joint, such as the hip, and which may in a later stage become generalised. The disease, as it affects the hip in elderly people (*morbus coxæ senilis*), represents a distinct clinical variety, and is fully dealt with in Chapter XXX. The clinical variety so commonly met with in the knee-joints of women at or about the menopause is described in Chapter XXIX., and the affections of the temporo-maxillary, shoulder, elbow, wrist, and ankle are discussed in their respective chapters. Spondylitis deformans is dealt with separately in Part II., Chapter III.

General treatment of osteo-arthritis.—A glance at Figs. 17 and 18 more than suffices to show that joints so crippled are crippled beyond repair; yet much can be done to alleviate symptoms, to check the further progress of disease and to prevent deformity. If the part which injury plays, in many instances, in determining the onset of the disease is recognised, then treatment of injured joints on lines directed to the prevention of osteo-arthritis may be far-reaching. Many

cases of osteo-arthritis are doubtless preventable by prompt and judicious treatment of an internal derangement of the knee or other joints, and, vice versa, many cases of osteo-arthritis arise from neglect to cut short frequently-recurrent attacks of chronic synovitis by active treatment (*see* Chapter XIX.).

Rest and massage.—The influence of rest on the course of osteo-arthritis is a question of much importance. Observation shows that in the generality of cases, if the affected joints are kept at complete rest—as, for instance, by means of splints—they become more and more stiff; while, on the other hand, stiffness is kept in check by moderate exercise. It is, therefore, customary to recommend patients to persevere in the effort of walking, even though the joints are very weak and painful, and although after exercise pain is considerably increased. I venture to say that in many instances this recommendation is carried too far. In the early stage of the disease, and in cases of moderate intensity, exercise short of fatigue is distinctly beneficial; it tends to diminish both weakness and stiffness. But when pain is severe, and is aggravated by exercise, great benefit will be obtained by keeping the joint completely at rest. I have on several occasions seen very marked relief obtained by weight-extension in the case of the hip, and by leather splints for the knee. The best rule appears to be to let the degree of pain and the effect of exercise determine the amount of movement that should be prescribed. Joints that are not painful are the better for moderate exercise; but if pain is present, and if it is aggravated by movement, rest with such mechanical support as may seem necessary should be employed. At the same time the joints should be protected from exposure to changes of temperature and rubbed with the linimentum potassii iodidi.

The value of massage under skilled supervision

cannot be too highly extolled in these cases, more especially in the case of the knee and hip, to improve the nutrition of the muscles and to prevent further wasting and contraction-deformities. If the disease is active, the joints themselves, as already stated, are best kept at rest. In the quiescent stage, when no pain is present, massage may be applied to the joints themselves, and judiciously controlled movements, both active and passive, may be permitted.

Hydrotherapeutics.—Hydrotherapeutics are of considerable value for relieving pain and improving the circulation and general nutrition of the joints and muscles. Hot-douching, if arranged so that the pressure can be regulated, often has a very sedative effect on the nerve-endings, and by its anodyne action permits of movements otherwise impossible, so that it becomes a valuable adjunct to massage and movement. The combination of douching, massage, and movement known as the Aix-les-Bains massage-douche is deservedly popular. Tissue-change is stimulated by artificial pyrexia, produced by hot bathing, and the skin is encouraged to act. At the same time a liberal ingestion of mineral waters increases elimination of waste products in the urine. Vapour-baths, radiant heat, and hot-air baths are sometimes of great benefit in relieving pain and stiffness. In some cases high-frequency currents have proved useful in relieving pain. More recently, cataphoresis has been employed with the object of promoting the absorption of fibrous tissue and increasing mobility. Lithium salicylates and iodine have been introduced into joints in this way with benefit. Patients who can do so should go to some health resort where hot bathing and douching can be obtained: to Bath, Buxton, Harrogate, Droitwich, Leamington, or Woodhall Spa. The climate of Bath, in the centre of the town, is humid and sedative, especially in the hot months of

sell
them

summer; but in the higher parts around it is at all times excellent; in the spring and late autumn it is genial and soft. Bath possesses the only hot spring in the British Isles; the natural temperature of the water is 117° – 120° . Bath is especially suitable for those advanced in years and for patients who combine with osteo-arthritis gouty tendencies. Buxton is 1,200 feet above sea-level, and although there is sometimes a heavy rainfall the weather throughout the summer and autumn months (May to about the end of September) is, in dry seasons, delightful. At Harrogate, which, like Buxton, is considerably above the level of the sea, the rainfall is less; but the wind is often strong and cold in the spring and late autumn. Both are best visited during the warm and dry months of summer. Buxton is best suited for cases in which the joint-affections are unaccompanied by marked debility or anæmia, and in which the use of hot water alone is required. Harrogate affords the advantage of its alkaline and chalybeate waters to those who are weakly or anæmic, or whose arthritis is connected with the uric-acid diathesis. The strong brine-baths of Droitwich are often of very great service. The climates of Leamington and Woodhall Spa are dry and bracing. In all these health resorts hotel accommodation is good and in many it leaves nothing to be desired, while the baths and douches are fitted with all recent improvements. Among the best health resorts on the Continent for this affection are Aix-les-Bains, Nauheim, Vernet-les-Bains, Wildbad, Baden-Baden, and Teplitz. (Chapter XI.)

Counter-irritation.—The general impression that counter-irritation is not of much service in cases of long standing is probably correct; but there are many cases, especially where any degree of inflammation attended with pain is present, in which a series of small blisters applied to the affected joints, one vesicle being allowed

to heal before the next is raised, may be very advantageously used. Counter-irritation to the spine, applied over the cervical enlargement for the joints of the upper extremities, and over the lumbar enlargement for the joints of the lower extremities, is sometimes of benefit. Blisters are applied on either side of the spinous processes, and kept open by means of savon ointment gently rubbed in. This form of treatment was first introduced by Dr. P. W. Latham, and is strongly advocated by Dr. W. J. Midelton, of Bournemouth,* for the relief of pain and for general improvement in the mental and physical condition of the patient.

Diet and drugs.—Speaking generally, no modification or restriction in diet is required. In the localised form which attacks the knees of women at or near the menopause, Dr. Llewellyn Jones, of Bath,† strongly advocates a restricted diet to check the increase in body-weight which so commonly occurs at this period. He advocates great reduction or abolition of carbohydrates and fats and malt liquors. In these cases thyroid extract should be given. Many drugs have been recommended. The most useful are aspirin for the relief of pain, and a combination of arsenic, iron, and cod-liver oil in debilitated subjects. Many authorities strongly advocate guaiacum and sulphur, given in cachets containing 3 grains of each, three times a day. In cases in which effusion is present, iodide of potassium or sodium should be added to these.

The special treatment of individual joints is referred to under the heading of Osteo-Arthritis in Chapters XXIII.—XXX.

For the treatment of rheumatoid arthritis the reader is referred to the many excellent monographs on the subject.

* *Journ. of Bal. and Clim.*, April, 1909.

† Llewellyn Jones, "Arthritis Deformans." 1909.

HYPERTROPHIC OSTEO-ARTHROPATHY*

The term *ostéo-arthropathie hypertrophiante pneumonique* was applied by Pierre Marie, in 1890, to an affection which he was the first to distinguish from acromegaly, with which it had previously been confounded. The symptoms comprise enlargement of the hands and feet, with clubbing of the fingers and toes, symmetrical swelling of certain joints, and thickening of the shafts of some of the long bones.

This "sign-group" is in almost all cases secondary to diseased conditions of the lungs, bronchi, or pleuræ, of which the most common are bronchiectasis, pulmonary tuberculosis, empyema and malignant disease. In a few instances cirrhosis of the liver or obstruction of the bile-ducts has been the cause, whilst two cases at least have been reported in which no underlying disease was discoverable.

The affection is about five times as common in men as in women, and though its victims are usually middle-aged, a few have been children, and in some it is supposed to have been congenital. In a patient of Berent's, suffering from an aneurysm of the left subclavian artery, changes similar to, if not identical with, those of hypertrophic osteo-arthropathy were present in the left arm and hand only; but in the great majority of cases the affection is bilaterally symmetrical.

Morbid anatomy.—The chief signs of the disease are three:—

1. *Clubbing of the fingers and toes.*—This has been present in all the cases recorded. The swelling which gives rise to the drumstick appearance of the digits is due to hyperplasia of the fibrous and fatty tissue in their extremities; the terminal phalanges themselves are

* For this account I am indebted to Dr. R. Waterhouse, of Bath.

unaffected (Fig. 21). As a rule, there is no cyanosis. The nails are striated longitudinally, are very large and curved, and have been aptly compared to watch-glasses, or, when viewed from the side, to the beak of a parrot. Clubbing of the end of the nose has been described.

2. *Changes in the joints.*—There is gelatinous thickening of the synovial membrane, with effusion of fluid into

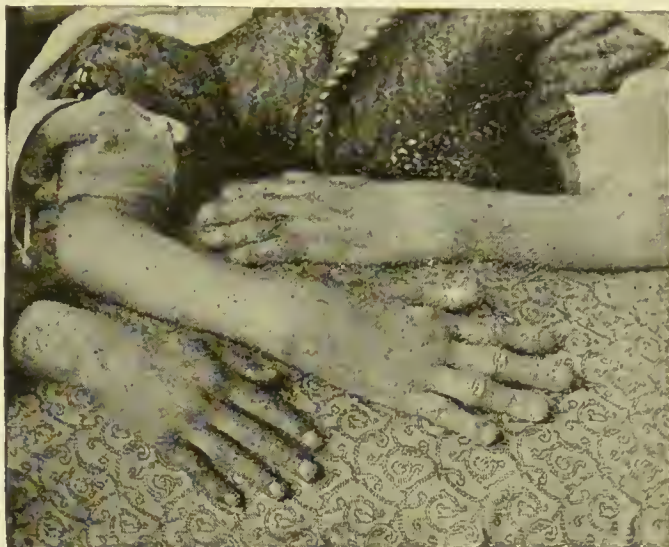


Fig. 21.—Clubbing of the fingers and swelling of the wrists in pulmonary osteo-arthropathy, seen in comparison with a normal hand. (A male, aged 38, under the care of Dr. Waterhouse.)

the cavity of the articulation. In some instances erosion of cartilage, apparently similar to that met with in multiarticular rheumatoid arthritis, has been found. The joints commonly involved are the wrists, ankles, and knees, and more rarely the interphalangeal, metacarpophalangeal, and elbow.

3. *Changes in the bones.*—A friable sheath of new bone is deposited beneath the periosteum, whilst the compact tissue of the bone becomes rarefied.

The shafts of the metacarpal and metatarsal bones ;



PLATE 3.—HAND AND WRIST IN PULMONARY OSTEO-ARTHROPATHY.

The plate shows a periosteal deposit of new bone on all the shafts of the phalanges and metacarpals, and on the radius and ulna. The outlines of some of the shafts are convex instead of concave. No changes are seen in the articulations. The proximal phalangeal joints are obviously swollen, and the clubbing of the fingers is distinct.

(From a patient under the care of Dr. Waterhouse. Radiogram lent by Dr. Strangeways.)

the first, and sometimes the second, row of phalanges; and the lower four or five inches of the bones of the forearm and leg are most frequently affected.

Other bones which have been found enlarged are those of the carpus, the upper end of the radius and ulna, the lower end of the humerus, the clavicles, scapulæ, vertebræ, ribs, iliac crests, lower end of the femur, patellæ, and upper end of the tibia and fibula. By means of the X-rays the ensheathing layer of new bone can often be seen before its presence can be detected with certainty by other methods. This is well illustrated by Plates III. and IV., which are taken from radiograms kindly lent by Dr. Strangeways, of Cambridge.

In addition to the above, which may be regarded as the three cardinal signs of this disease, may be mentioned a general swelling of the soft parts of the extremities, resembling œdema, but pitting only with difficulty or not at all on pressure; a peculiar limp, "floppy" character of the enlarged hands; sweating of the fingers and palms, causing an unpleasant clamminess; and a general clumsiness of movement, so that delicate manipulations can no longer be performed.

Kyphosis is not infrequent, and, in contrast to the cervico-dorsal curvature of acromegaly, usually has its seat in the dorso-lumbar region. Marie thinks it is due to lesions of the intervertebral articulations; in some cases it has been due to caries.

Scoliosis, when present, is usually the result of accompanying intrathoracic disease.

Pain is a variable symptom, sometimes present whilst the enlargement is taking place, especially if this occurs rapidly; in many, perhaps the majority, it is absent throughout.

Clinical course.—The course of the affection depends upon that of the primary disease. If this is recovered

from, the arthropathies quickly subside, the clubbing disappears later, and finally, to judge from a case reported by Finlay Alexander, it is probable that the new bone may be almost completely absorbed.

In the majority of instances, however, the primary condition being one from which recovery does not, as a rule, occur, the clubbing of the extremities and the enlargement of the bones persist, though return of the joints to normal has been noted in several instances.

Pathology.—Many hypotheses have been advanced to explain this remarkable group of symptoms. Marie suggested that it was analogous to the pseudo-rheumatism of infectious or toxie origin described by Bouchard; Thorburn, that it was a tuberculous process of slight intensity; Bécélère, that it was due to tissue-toxins whose normal excretion by the lungs was interfered with through loss of lung-tissue or impaired action of the diaphragm; and Sahli, that the condition was neuropathic.

None of these theories can be said to give a satisfactory explanation of all cases.

Treatment.—The treatment consists in an attempt to cure the primary disease and to treat symptoms on general principles.



PLATE 4.—SKIAGRAM FROM THE SAME PATIENT AS IN PLATE 3, TAKEN
THREE MONTHS LATER.

The deposit of new bone is more compact; the shadow thrown by it is deeper, and the outline of the normal bone less clearly seen. The swelling of the proximal phalangeal joints is less pronounced, and the clubbing of the fingers more distinct.

CHAPTER X

ACUTE RHEUMATIC ARTHRITIS

THE subject of acute rheumatism, or rheumatic fever, belongs to the province rather of the physician than of the surgeon. But, considering that joints affected by this variety of inflammation may require surgical treatment, it is necessary to describe briefly the changes to which they are liable.

In the great majority of cases these changes are similar to those which are found in cases of simple synovitis already described, and the usual result is a complete restoration of the articulation to its former healthy condition.

But in acute rheumatism there is a tendency for the disease to affect structures other than the synovial membrane; thus the subsynovial and the periarticular tissues are not uncommonly the seat of inflammatory exudation. The cartilages in severe cases present a bluish or opalescent tint, and may in places become distinctly swollen; microscopically examined, they are found to be the seat of cell-proliferation, and in a few instances they become fibrillated or eroded. Further, the inflammation may extend to the bones and ligaments, and, in rare instances, suppurative inflammation of the joint may occur. The characters of the synovial fluid in cases of acute rheumatism necessarily vary with the intensity of the inflammation, and with the structures that are involved. In general terms the fluid may be said to resemble that of simple synovitis, but it contains much more fibrin, and is consequently shreddy. Though

the cause of acute rheumatism is still uncertain, recent researches tend towards establishing a bacterial origin.

Bacteriology.—Drs. Poynton and Paine have in upwards of thirty cases of rheumatic fever isolated an organism, the “*Diplococcus rheumaticus*,” and have produced in rabbits a similar arthritis, and have demonstrated the organism in both human and animal tissues; and on these grounds they claim for the organism a specific agency in acute rheumatism. Vernon Shaw has produced a similar arthritis in monkeys with one of the same cultures. In confirmation of the researches of Drs. Poynton and Paine, many other observers, notably Ainley Walker and Beatson, Beattie, Triboulet, and Wassermann, have demonstrated a diplococcus in acute rheumatism. It is not easy to find the diplococcus in the arthritic fluid, because the organisms are deposited in the areolar tissue beneath the synovial membrane, and the cells lining the synovial cavity are phagocytic. Not only so, but numerous leucocytes, escaping into the synovial tissues and into the joint-cavity, may also aid in the destruction of the diplococci. The most suitable cases in which to find the diplococcus are those which are acute and severe, and in which the lining membranes are greatly damaged. The malignant types in which endocarditis or pericarditis are present also yield the diplococcus. Professor Beattie in one case found the diplococcus post-mortem in the congested areas of the synovial membrane, though the exudate was sterile.

As yet no specific tests have been discovered which clearly differentiate the “*Diplococcus rheumaticus*” from many of the strains of streptococci.

Drs. Andrewes and Horder* have published their researches into the classification of “streptococci pathogenic to man.” By the aid of extensive chemical tests,

* *Lancet*, Sept., 1906.

following the original researches of Dr. Mervyn Gordon, they have been able to group the streptococci into definite types, each type having several species, or variants. In investigating two specimens of the "Diplococcus rheumaticus" received from Drs. Poynton and Beattie respectively, they were able to place each specimen in a common intestinal class of the streptococci. In referring to the supposed etiological relationship of this organism to acute rheumatism, they raise the doubt whether it may not have been present as an incidental terminal infection, or, when isolated in cases of acute rheumatism at some considerable period before death, whether it may not have been the cause, as a secondary infective agent, of a malignant endocarditis.

These authors have hitherto been unable to isolate the organism in rheumatic fever.

Dr. Ainley Walker,* in reviewing the bacteriology of this disease, states his conclusion that "from a clinical standpoint acute rheumatism is a disease *sui generis*, and is therefore probably due to a single definite infective micro-organism. But before this can be regarded as in any way established, probably the whole question must be re-investigated *ab initio*. First, it must be shown that the organism can by suitable methods be obtained from a long series of cases, which must be chosen with a due regard to their acuteness and their freedom from suspicion of complications; and, secondly, it must be clearly demonstrated that the organism itself is a distinct and definite variety of streptococcus."

Symptoms.—As an example of acute articular rheumatism, the case may be taken of a patient who, after being exposed to cold, or to cold and fatigue, has a chill, or possibly a rigor, followed by a rise of temperature to 100° or 102°, or even more, accompanied by copious

* *Brit. Med. Journ.*, May 25, 1907.

acid perspiration, and who a few hours later is seized with severe pain in one or more of the large joints, attended with rapid and great swelling due to considerable synovial effusion, and with such tenderness over the joint that he is unable to bear the slightest pressure, or even the weight of the bed-clothes. The pain is most severe at night, is subject to marked exacerbations, and is increased to agony on movement of the limb. Frequently some other joint, especially the corresponding articulation of the opposite side, is soon affected, while in severe cases many are attacked. The duration of the affection in any particular joint varies from a few hours to three weeks or more. Its erratic character is one of the most marked features of this disease. Often, in a joint that is hot, swollen, and intensely painful, all the symptoms rapidly subside, and in a few hours every trace of the affection has disappeared, while at the same time some other joint has, with equal suddenness, become involved. The articulations most apt to be affected are the knee, shoulder, and elbow, but none is exempt; and even the small joints of the hand and foot are often attacked. In many instances, when several joints have been involved, the majority recover, while in one or more the disease maintains a pertinacious hold and runs on into the chronic form.

It will readily be understood that where the cartilages, ligaments, and surrounding connective tissues have been involved in the inflammatory change, more or less stiffening may result; and in some cases a genuine fibrous ankylosis leaves the articulation permanently fixed.

The ordinary duration of synovitis in any individual joint in a case of acute rheumatism varies from about three or four days to a fortnight, but in instances in which the deeper structures are implicated the inflammation frequently drifts on into a subacute or chronic

stage; and whilst the other articulations have become quite sound and painless, the affected joint (for rarely more than one is so involved) remains swollen and painful. The essential tendency of subacute or chronic rheumatic inflammation of a joint is towards the organisation of the inflammatory products into connective tissue, and not to simple cell-proliferation and the formation of pus. It thus happens that in protracted cases much thickening of the synovial membrane, of the capsular and other ligaments, and of the periarticular tissues, results; and it is to this thickening and to the contraction of the newly-formed fibrous tissue that the subsequent stiffness is due.

In the following case there was ankylosis, although no suppuration occurred.

J. B., æt. 21, was admitted into St. Bartholomew's Hospital suffering from acute rheumatism. The wrist-joints and the left shoulder were swollen and painful. Endocarditis was present. The temperature varied from 99° to 103.2° , and the left elbow- and knee-joints subsequently became implicated. The patient was treated with salicylate of sodium, and after a fortnight all the joints except the left knee were free from pain. The left knee, however, became more swollen and more painful, and was much distended with fluid. It was painted with iodine and wrapped in cotton-wool, but continued, nevertheless, to get worse. It was next treated by blisters and a back-splint, and in a fortnight the swelling and pain had subsided; but much pulpy thickening remained, and the bones of the leg were slightly displaced backwards. The limb was now fixed in a plaster-of-Paris splint, and finally, after some months, all pain passed away; but the joint was firmly ankylosed in an extended position.

In very rare instances the joint-disease may, as already said, progress to suppuration. This event is most likely to occur in patients who are tuberculous. If recovery takes place, true bony ankylosis will generally follow, although repair with a movable joint may result.

The **diagnosis** between acute rheumatism and gout may be arrived at by bearing in mind that rheumatism

may occur at any age from infancy onwards, while gout is most common between the ages of forty and sixty, although it may occur before the age of thirty; that rheumatism is often complicated with endocarditis or pericarditis, and is attended by high temperature, copious sweating, and considerable constitutional disturbance, while in gout the temperature is less raised (it may, however, in some acute cases reach 101° or even 102°), and the general health is but little affected; that in rheumatism pain is less severe and less paroxysmal than in gout; that in the majority of cases the first attack of acute gout is in the great toe. In chronic gout, deposits of urate of soda may often be detected in the finger-joints, skin, cartilages of the ears, and other parts.

Treatment.—The limb should be placed in the position of greatest ease, and be supported with pillows. Great relief sometimes attends the application of splints to the joint, as recommended by Dr. Robert Bridges.* The best material is poroplastic felt, softened in steam or hot water, and well padded with an even and thick layer of cotton-wool. It should be applied on the surface on which the joint is resting, and be retained by an easy bandage above and below the joint. The joint may be either wrapped in a thick layer of cotton-wool, or hot poppy fomentations, lead-and-opium lotion, or belladonna liniment sprinkled on lint, may be used. The plan of blistering the joint in the acute stage, as advised by the late Dr. Herbert Davis, sometimes gives speedy relief. Experience shows that the aspiration of a joint that has suddenly become tightly distended gives great relief; nevertheless, this proceeding had better not be ventured upon unless distension is very marked and pain very severe. Though this is rarely the case, the acute form of inflammation

* *St. Bartholomew's Hosp. Repts.*, xii. 175.

may leave the articulation permanently stiff, or with movement very considerably impaired. If, therefore; the attack is prolonged for more than a week or ten days, it will be advisable to place the joint on a splint, in a good position for future use, in the anticipation that movement may possibly remain limited. To effect this, it may be necessary, in order both to relax the muscles and to save pain, to give an anæsthetic. Should the extremely rare event of suppuration occur, the case must be treated in the manner described at p. 129. In the severer forms, in consequence of rapid muscular wasting and relaxation of the ligaments in such joints as the knee, wrist, and ankle, there is a marked tendency to displacement and deformity. Should this result threaten, no time must be lost in supporting the bones that form the joint, by the accurate application of efficient splints.

CHRONIC RHEUMATISM

When chronic rheumatism follows on the acute form, the affected joints remain enlarged, hot, tender on pressure, painful, especially on movement, or when the limb is warm in bed; and so stiff and weak that the patient is unable to grasp any object, or, in the case of the lower extremity, to bear any weight on the limb. Usually several joints are affected, either together or in succession. The knees, ankles, shoulders, wrists, and the small finger-joints are more commonly involved than the shoulder or the hip. The disease is sometimes irregular in its course, changing its place from joint to joint, subsiding and relapsing, and varying in its intensity from day to day according to the state of the weather as to temperature, wind, and damp; while sometimes one of the large joints remains affected long after the patient has otherwise completely recovered. The local signs are often accompanied with a minor

degree of fever. The affection may last for many weeks or months, and in some instances the joint never recovers its normal condition, but remains permanently enlarged, stiff, weak, and painful. In another variety the disease assumes from the first a chronic and insidious form, attended with pain, stiffness, and weakness, rather than with any marked heat or swelling. Pain and stiffness are aggravated by exposure to cold, and are more marked when the joint is first moved after having been at rest. Another symptom is that of creaking, grating, or snapping of the joint on movement. As the affection advances, considerable nodulation and enlargement of the articular ends of the bones may take place, and the joints may thus become distorted and crippled. In some cases there is so much effusion into the synovial cavity of the knee- or elbow-joint that the disease constitutes one of the forms of hydrarthrosis.

Treatment.—Patients subject to chronic rheumatism should be advised to use flannel underclothing both in warm and in cold weather, so that as far as possible a uniform temperature of the skin may be maintained; and to wear a knitted woollen cap or some similar covering over any joint that is affected. Fatigue should be avoided, but absolute fixation of the affected joints is not to be recommended, except in the early period of the attack, for if continued it tends to promote stiffness. It is a common experience that patients suffer both less pain and less inconvenience from stiffness when they keep the affected joint in moderate use. For local treatment, the hot douche, followed by cold (Scotch douche), or fomentation night and morning, or the local vapour-bath, will give most relief. A convenient apparatus for steaming the different joints may be had of any instrument-maker; or, failing this, if a space is maintained round the joint by a fracture-

cradle or some similar contrivance, hot vapour may be applied by means of the ordinary croup-kettle fitted with a long spout. When it is possible to obtain them electric-light baths (radiant heat) are often of great benefit. In the later stages a succession of small blisters, massage, and passive movements after the hot bathing, will be very beneficial; while if much fluid is present, strapping with Scott's dressing (ung. hydrarg. co.), or the application of the elastic rubber-bandage, will be of service. The more obstinate cases of effusion may be treated by aspiration. In some instances a weak constant electric current (5-10 milliamperes) does good, both by restoring tone to the muscles and by relieving pain; this is more efficacious if immediately followed by massage. Obstinate cases may be benefited by Bier's method of "passive congestion" (p. 57). The question of forcible movement is discussed at p. 141.

General treatment should include the use of alkalis, in the form either of bicarbonate of potash (of which 15 grains may be combined with an infusion of gentian, cinchona, or other vegetable tonic), or citrate of potash (of which 20 grains may be taken every morning, or twice a day, in a tumbler of water); while if the patient is weak and anæmic, quinine and iron should also be prescribed. Guaiacum, combined with sulphur and in the form of tabloids, is still sometimes prescribed. In many instances it does no good, but in obstinate cases it may be worth a trial. Iodide of potassium, in doses of 3 to 7 grains, often gives relief. This drug should be combined with citrate or bicarbonate of potash, or be taken with some natural alkaline water. Great benefit is often obtained from salicylate of soda, given in 10-grain doses three times a day. Free elimination by the bowels should be maintained. Malt liquors must be forbidden, and wine, if allowed at all, must be taken in small quantities, nor must the

various kinds be mixed. A small amount of whisky is the form of alcohol which is most often harmless.

A damp climate is to be avoided. Great benefit often results from a residence of a month or six weeks during the summer at Buxton, Harrogate, Leamington, or one of the other English health resorts, where an atmosphere well above the level of the sea is combined with the baths and the internal use of the waters. In the cool seasons of the year, Bath, for the development of which as a health resort so much has been done, may be strongly recommended. Amongst the chief resorts on the Continent valuable in chronic rheumatism are Aix-les-Bains, Nauheim, Wildbad, and Baden.

CHAPTER XI

ARTHRITIS IN GOUT

UNDER the term "gout" (*gutta*, the "drop" of peccant humour), a fossil remnant of the old humoral pathology, are included all those morbid phenomena which are intimately connected with over-production and imperfect elimination or destruction of uric acid. In health, uric acid is produced from the nucleins and purin bases of the food and from the nucleins of the body-tissues. In gout, uric acid is found in excess in the blood and is deposited in the tissues in the form of biurate of soda. Neither the origin nor the cause of this excess has as yet been definitely established, nor is it certain that the paroxysms of gout which coincide with the excess owe their origin to the excess alone. In considering the symptoms of gout and the prominence of the arthritic manifestations, the toxic theory of the origin of gout becomes strongly attractive. Luff* believes that the primary cause of gout is a bacterial toxin, and lays stress on the well-known fact that adequate removal of the intestinal contents at the commencement of an attack always results in a rapid diminution of the symptoms; and he points out that the classic remedies for gout have only two things in common: one that they relieve gout, and the other that they check intestinal putrefaction, or promote the elimination of its products from the system.

The manifestations of gout cover a wide range, and concern not only the joints, with which this chapter

* "Gout, its Pathology and Treatment," 3rd ed., 1907.

mainly deals, but also the circulatory and nervous systems, the fibrous tissues, such as the fasciæ, tendons, and bursæ, and the internal organs, such as the stomach and bladder. Thus gout cannot be correctly spoken of as a disease like, for instance, enteric fever, in which a more or less uniform train of events and symptoms characterises its progress; for the term embraces many affections which, though dependent on the same condition, differ greatly from each other, such as acute arthritis, phlebitis, neuralgia, and skin eruptions.

In clinical practice a disorder so variable is easily overlooked or misapprehended. It therefore demands no little attention, nor can the surgeon neglect its study on the plea of its medical aspects. There are some aspects of gout which are surgical rather than medical, and with which the surgeon must be familiar, for he will be called upon not only to diagnose but to treat them.

Gout, though often hereditary, may be acquired, so that absence of a family history must not be allowed, to any large extent, to influence diagnosis. Nor must it be forgotten that some patients have such a dread of gout that they will deny the existence of a family history of which they are well aware. The original onset often takes the form of an acute arthritis, usually of the first joint of the great toe, or of the knee, ankle, or wrist. The hip and shoulder usually escape a first attack, nor are they so prone as the other joints to be subsequently involved. In many individuals gout is from first to last imperfectly developed, and therefore readily overlooked. Men suffer more than women, their mode of life and diet being more conducive to it. The majority of cases commence in middle life, between thirty and fifty; but acute attacks are not very uncommon in the young adult, and some have been reported in boys of fourteen. Some writers have even recorded cases of gout in infants at the breast, but it

may reasonably be questioned whether the condition may not have been due to some form of septic infection. Garrod long ago pointed out that painters, plumbers, and others who are exposed to chronic lead-poisoning are especially liable to gout. It has been stated that in such patients albuminuria is frequently present.

Gout is far more commonly met with among the rich than among the poor, and for this reason, and also on account of its extreme painfulness, has been styled "*dominus morborum et morbus dominorum*." "It may," says Sydenham, "be some consolation to those sufferers from this disease who, like myself, are but moderately endowed with fortune and intellectual gifts, that great kings, princes, generals, admirals, philosophers, and many more of like eminence, have suffered from the same complaint and ultimately died of it. In a word, gout, unlike any other disease, kills more rich men than poor, more wise than simple. Indeed, Nature, the mother and ruler of all, shows in this that she is impartial and no respecter of persons, those who are deficient in one respect being more richly endowed in another, her munificent provision for some being tempered by an equitable proportion of evil."

Morbid anatomy.—The immediate cause of the clinical phenomena of gout, whether in the joints or in other parts, is believed to be the deposit from the blood of biurate of soda in the form of acicular crystals. When this deposit is rapid and in considerable amount in the cartilage and other structures of the joint, an acute arthritis is produced. When the deposit is more limited and more gradual, the affection, although more prolonged and tedious, is of a much milder type. The changes that take place in the articulations are briefly these: In an acute attack of gout the synovial membrane presents appearances identical with those of acute inflammation, and the synovial fluid is similarly altered

in character and consistency. The articular cartilages become inflamed, their cells multiply, and their matrix fibrillates. In the substance of the cartilage and upon its free surface a remarkable white deposit, consisting of biurate of soda, occurs either irregularly or as a uniform layer (Fig. 22A). Gradually the diseased cartilage is removed by erosion, and the articular ends of the bones are exposed. These, in turn, become the seat of inflammatory changes attended with a similar deposit of biurate of soda (Fig. 23). When sections of the cartilage are examined microscopically, the matrix is seen to be granular and eroded wherever the deposit is excessive; but where the deposit is slight, little or no change is seen.

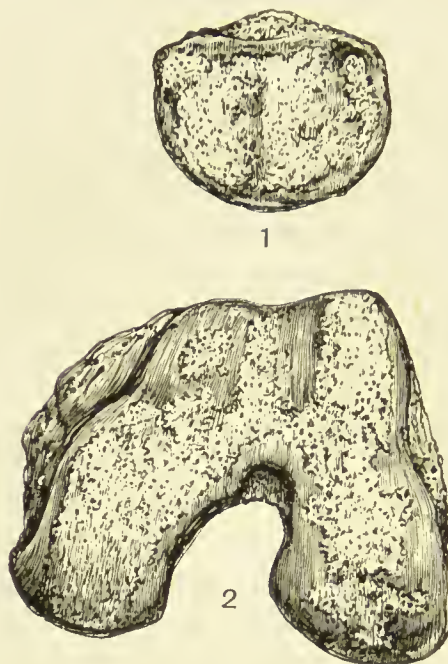


Fig. 22.—Irregular deposit of biurate of soda on the condyles of the femur and on the patella.

From a specimen, No. 708, in St. Bartholomew's Hosp. Mus.)

It seems probable that the urates which are dissolved in the synovial fluid penetrate the cartilage and other tissues by lymph diffusion and then become precipitated, and that the change in the cartilage is reactionary. Precipitation probably only occurs when the synovial fluid is over-saturated, and clinical evidence suggests that re-resolution does sometimes occur, presumably when the degree of saturation is greatly diminished.

Sir Dyce Duckworth has shown that definite attacks of gout may occur in the big toe and yet no deposit be found in the joint post-mortem; which suggests, though it does not prove, resolution. Sir A. Garrod laid it down as a rule that gouty inflammation is always attended with a deposit of biurate of soda, and it is probably equally true that a deposit will not be found in a joint which has not been the seat of an attack. The fact that the stress falls

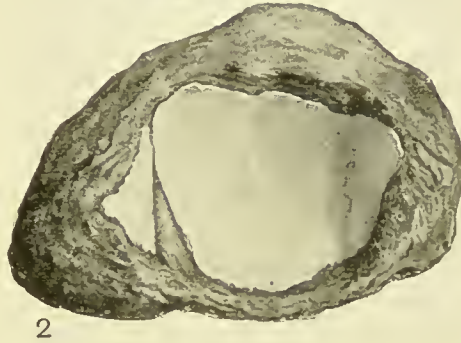


Fig. 22A.—Deposit of biurate of soda in a smooth, uniform layer, on the articular cartilage of (1) the astragalus, and (2) the lower end of the tibia.

(From a specimen, No. 709B, in St. Bartholomew's Hosp. Mus.)

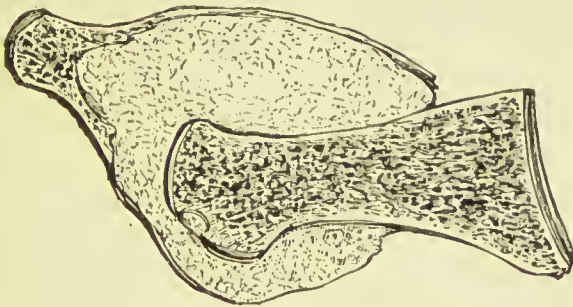


Fig. 23.—Section of a great toe, showing deposits of biurate of soda in the bones and surrounding soft parts. The base of the proximal phalanx is in great part destroyed.

(From a specimen, No. 711, in St. Bartholomew's Hosp. Mus.)

more on the cartilage than on the fibrous tissue is due to the sluggishness of the lymph circulation and the feeble nutrition of the cartilage as opposed to the other con-

nective tissues. The synovial fluid leads a sluggish existence somewhat remote from the bustling blood-stream, which may perhaps explain the susceptibility of joints to chemical as well as bacterial poisons—a susceptibility accentuated by a sedentary life.

In advanced cases a chronic arthritis will result,



Fig. 24.—Illustrating suppuration with the formation of sinuses in gout attacking the metatarso-phalangeal joint of the great toe.

(From a specimen, No. 711r, in St. Bartholomew's Hosp. Mus.)

closely resembling, clinically, some forms of chronic rheumatoid arthritis; the changes which are directly due to gout having given way to changes common to many forms of chronic osteo-arthritis. In a few cases synostosis results. This, however, is rare, but may be met with in the small joints of the hand and foot. The ligaments, periarticular connective tissues, and bursæ around the joints may all become involved and infiltrated with a similar deposit. When the skin becomes stretched

over these subcutaneous tophi, ulceration may result, and a discharge of the chalky material take place. In rare cases an infection by micro-organisms follows, and a suppurating joint results. Cases of acute suppuration in gouty joints have been recorded by Stephen Paget,*

* *Clin. Soc. Trans.*, xx. 232.

Norman Moore, and others. That a joint which is disorganised by gout is liable to become the seat of an acute arthritis under the stress of a general blood-infection is obvious. In Paget's case a large abscess formed in the thigh, communicating with the knee-joint, and death ultimately occurred from exhaustion. The knee-joint is preserved in the museum of St. Bartholomew's Hospital, and shows signs of an acute septic arthritis, while other joints in the body showed undoubted evidence of gout. Figs. 24 and 24A well illustrate suppuration following gout in the metatarso-phalangeal joint of the great toe. In and around the joint there is a deposit of biurate of soda. Between the joint and the skin are several sinuses, which discharged pus during life, and the head of the metatarsal bone is considerably eroded. The specimen was removed by amputation from a man of 53, who had suffered from gout for twenty-eight years, and who, two years before the operation, during an acute attack, had pricked the swollen toe with a needle and expressed some of the chalky material.



Fig. 24A.—Surface view of Fig. 24.

(From a specimen, No. 711E, in St. Bartholomew's Hosp. Mus.)

Recently attention has been drawn by means of the X-rays to changes which take place within the bones in

gout, changes that closely resemble those which occur in some forms of rheumatoid arthritis.

Localised transparent areas may be seen in the distal extremities of the phalanges, having the appearance of small punched-out holes. These are usually situated in the bones near the diseased joints, but show no communication with the joint-cavities.

Dr. T. S. P. Strangeways* has made dissections of bones in which these changes have been demonstrated by means of the X-rays. He has found in cases both of chronic gout and of rheumatoid arthritis that the bone is definitely eroded and filled with a gelatinous-looking substance. In the advanced cases of gout a characteristic deposit of urates was also found adhering to the margin of the cavities. Berkart† examined similar changes microscopically, and found deposits of urate crystals in the bone-marrow, cut across in places by trabeculae of dead bone.

In addition to these transparent areas, small nodes or bony deposits are sometimes met with at the sides of the phalanges. Attention was called to these many years ago by Dr. Wynne, from cases seen in Sir Dyce Duckworth's wards at St. Bartholomew's.

More recently Dr. Ironside Bruce has, by means of the X-rays, focussed our attention on these gouty exostoses (Bruce's nodes), which are true bone, and not urates (the latter are transparent to the rays).

New bone may also be deposited in chronic gout round the margins of the articular surfaces, either irregularly or in the form of spurs, and has also been seen round sesamoid bones, such as those in the tendons of the flexor brevis pollicis.

Without clinical evidence it is frequently impossible

* *Bulletin of the Committee for the Study of Special Diseases*, vol. i. (Cambridge).

† *Brit. Med. Journ.*, 1895, i. 243.

to tell, from the skiagrams alone, whether the case is one of chronic gout or of rheumatoid arthritis. All the changes seen in cases of undoubted gout may be seen also in cases in which there is no clinical evidence of gout.

No explanation is as yet forthcoming as to how these eroded areas are caused. That they are not produced by pressure

seems clear from the fact that, where erosion is marked, tophi are usually absent; and where large tophi are present, no atrophy occurs (see Fig. 23), but often, on the contrary, new bone is laid down.

In an acute attack of gout the bursæ in the neighbourhood of joints may become inflamed, and in chronic gout large deposits of urates are often formed, giving rise to



Fig. 25.—Large deposit of urate of soda in a prepatellar bursa. There is also a deposit in the articular cartilage.

considerable inconvenience and frequently to inflammation of the skin over them. This enlargement, as in gummatous bursitis, is usually symmetrical. Fig. 25 is a unique specimen showing a deposit of remarkable size in the prepatellar bursa, and it will also be noted that the articular cartilage is similarly involved. The specimen was taken from a man, 56 years of age, whose knees and elbows, hands and feet, showed extensive deposits. The prepatellar and olecranon bursæ of both sides were greatly enlarged and loaded with

solid deposits of biurate of soda. The kidneys presented a striking appearance owing to the deposit of linear streaks of urates in the pyramids. This patient had survived an attack of tuberculosis which had involved the apices of the lungs and the glands of the mesentery, as was shown by old tuberculous calcareous deposits in both these situations.

In long-standing cases the pain, stiffness and deformity are largely due to the degenerative changes which have gradually occurred.

Symptoms.—There is no space here for a full clinical description of gout, and the account now to be given will have reference mainly to the disorder as it affects the joints. It occurs in two chief forms, the acute and the chronic, connected with each other, however, by numerous intermediate grades. The following is a typical case of the acute variety: A patient who has gone to bed, as he believes, in his usual health, or who has perhaps been passing scanty and high-coloured urine, turbid on cooling from urates, and has suffered for a few days with loss of appetite, flatulence, heart-burn, and slight nausea, or other signs of dyspepsia, and with twinges of pain in the finger-joints, fugitive muscular pains, or threatenings of lumbago, awakes two or three hours after midnight with an uneasy sensation or a sharp pain in the metatarso-phalangeal joint of the great toe, accompanied by a feeling of chilliness, or even by a distinct rigor, succeeded by heat and perspiration. The temperature may be 102° or 103° . The pain increases until it is almost unbearable, and is of a grinding, wrenching, or burning character, as if a hot iron were being forced into the joint. According to Sir Thomas Watson, a humorous Frenchman thus described its intensity: "Place your joint in a vice, and screw the vice up until you can bear it no longer; that may represent rheumatism. Then give the vice another

twist, and you will obtain a notion of gout." The toe is exquisitely sensitive, so that the patient cannot bear the weight of the bed-clothes upon it, or even the jar of a heavy footstep in the room; and, while he is unable to keep the limb in any one position, every movement tends to increase his suffering. The whole toe becomes stiff, swollen, hot, and suffused with a bright-red, or sometimes with a more dusky tint; the veins in the surrounding skin are distended and prominent; and the subcutaneous tissue is œdematous and pits on pressure. To hang the foot down produces an agonising feeling of tension or bursting. After a few hours the swelling increases, the pain moderates, and the day is passed in less distress; but at night the attack renews itself in all its first intensity, and the patient feels feverish, restless, and miserable. Towards morning, however, perspiration comes on and he falls asleep; and when he awakes he finds that the symptoms of local inflammation have considerably moderated, and he is able to move, and bear pressure on, the joint. These phenomena of subsidence during the day and exacerbation at night continue for two or three days or more, and then pass off, and are followed by desquamation of the cuticle, attended with troublesome itching.

Left to itself, the attack lasts for a week or ten days, sometimes even for three weeks, but when adequate treatment is adopted it usually subsides within three or four days. Although the ball of the great toe is the most common seat of a first attack, the original seizure may involve any of the other articulations. As the affection declines in one joint, it is not unlikely to appear in some other, often in the corresponding joint of the opposite foot, or in a knee or an ankle, where it runs much the same course as that just described, although it is generally less severe and of shorter duration.

All the joints are liable to attack, but the hip and shoulder usually escape. In patients of weak health, especially women, gout assumes an asthenic character, and the pain, heat, redness, and swelling are much less marked. In these cases, however, the affection is apt to be very tedious, and the joints are often left in a weak and crippled state. At first a joint, when the gouty attack has subsided, regains its former strength and mobility, but when it has been several times affected it is liable to considerable permanent weakness and stiffness. Complete bony ankylosis, though rare, is, as already mentioned, occasionally met with.

An acute attack of gout may be induced by a variety of causes: by an indiscretion in diet, especially the free use of malt liquors or wine, or the admixture of different kinds of wine; by mental excitement, or by excessive fatigue; or by injury, as a fall from a horse, or even a slight sprain. I have seen sharp outbreaks after surgical operations, such as the removal of tumours, ligature of hæmorrhoids, and even division of the tendo Achillis. In one case, in a man of 50, acute gout followed vaccination, while Heberden states that he has witnessed the same result after so small an injury as a flea-bite. As the acute passes into the chronic form, though the attacks become somewhat less severe, they are apt to be more frequent and more prolonged, and to involve a larger number of joints, especially those of the hands and lower extremities. After repeated attacks the joints become distorted by enlargement and alteration in the shape of the articular ends of the bones, and eventually completely crippled. In some cases of chronic gout, the deposition of biurate of soda occurs in such large quantities as to produce tophi, or chalk-stones. Watson mentions a namesake of his own who was accustomed, when playing cards, to score the game upon the table with the chalk-stones which protruded from his

gouty knuckles. When these concretions attain a large size, they may lead to suppuration and the formation of tedious abscesses, discharging sanious pus, with a copious admixture of chalky urate of soda. As many as five or even more of such abscesses may exist in the same hand. These abscesses usually cause very little disturbance, but they are liable to remain open for many weeks, or even months together.

Diagnosis. — The question whether a particular joint-affection is of a gouty character is a matter not only of great clinical importance, but often of much difficulty. In forming a diagnosis the following points must be taken into consideration: the presence or absence of gout in the parents, or other blood relations of the patient; the patient's age (gout is very rare before puberty, and does not usually occur before the age of thirty-five or forty; it is common through all the later periods of life, up to very old age); the fact that the disease is much more common in the male sex than in women, in whom it is rare after menstruation has ceased. A full meat diet, combined with a free use of malt liquors or wine, especially when little exercise is taken, strongly promotes gout, while the inability to assimilate beer or wine may in itself be a sign of the affection. The nature of any previous attack, or of the present seizure if it be the first, must be considered, suggestive points being the sudden onset, affecting most frequently the ball of the great toe, the intensity and paroxysmal character of the pain, the exquisite tenderness of the surface, a cutaneous blush, œdema, distended veins, nocturnal exacerbations, slight constitutional disturbance, and the fact, often to be elicited, that previous and similar attacks have been separated by intervals of good health. It should be observed whether there are deposits of biurate of soda in the ears, fingers, or any of the various bursæ. The urine should be examined

for albumin—often present in chronic gout. Great caution, however, in forming a diagnosis is required. Sir James Paget has recorded a case in which, after the ligature of hæmorrhoids, acute inflammation of the great-toe-joint, dependent on pyæmia, was at first ascribed to acute gout. Sir Alfred Garrod mentions a similar case, and points out that the constitutional disturbance was from the first much greater than is met with in gout.

In his “Clinical Lectures and Essays,” which it was my good fortune to edit, Sir James Paget, in the chapter on Gout in some of its Surgical Relations,* points out the following as minor signs of the disease :

The hands and feet.—Darting and aching pains, and stiffness in the knuckles, especially after faults of diet, or when the patient wakes in the morning; burning palms or soles, pain and tenderness in the heel, or in the tendo Achillis, which may be thickened; numbness and tingling of one or more of the fingers or toes. The knuckles are enlarged, flattened, or spheroidal, and the skin over them is smooth, glossy, and often tense and warm. Later, the joints become more deformed, the fingers are flexed and distorted, and the whole hand is sloped towards the ulnar side of the limb. Often over one or more of the finger-joints there is either a subcutaneous bursa, or a thickening of the connective tissue, forming a disfiguring lump; or over a finger- or a toe-joint a little cyst may be developed, filled with a pellucid, yellowish, tenacious fluid. Many gouty persons have thickening and contraction of the palmar or, more rarely, of the plantar fascia, which becomes seamed and knotted, and tends, as it contracts, to draw down the fingers towards the palm. The ring-finger and the little finger are those most usually affected. (This condition constitutes one of the forms of “Dupuytren’s contraction.”)

* Second edition, p. 353.

The mouth and pharynx.—Attacks of pain and tenderness of the teeth, which become very sensitive to pressure, and feel as if they were raised out of their sockets and slightly loose ; psoriasis of the tongue, very like a squamous syphilide, in the form of bare purple or opaque white patches of thickened epithelium, like snail-tracks. Minor signs in the tongue are burning and aching, or neuralgia, alarming the patient with fears of cancer. The uvula is often elongated, and a source of troublesome coughing, or even of retching. Some gouty persons suffer from chronic pharyngitis, in which all the mucous membrane covering the pharynx and pillars of the fauces is smooth, thickened, oedematous, glossy, and dull-coloured ; others from pain in the palate, as if in some part of a single muscle, provoked by swallowing, and often shifting its place, or there may be a sensation of tickling in one small spot, as if a crumb were irritating the part.

The digestive organs.—Gouty persons are often flatulent and “bilious,” and many things disagree with them. Even small quantities of beer or wine produce burning in the soles and pain in the knuckles. Paget * states that he has known a patient have well-marked gout within ten minutes after drinking a glass of champagne.

The urinary organs.—Here minor signs are the deposit of urates and uric acid in the urine ; cystitis, leading to intense irritability of the bladder and burning sensation on the passage of urine, which contains mucus or pus, and, though very rarely, blood ; heat along the urethra, and sometimes a thin, purulent discharge. These bladder attacks often come on suddenly in the night, as gouty symptoms elsewhere subside. Persistent gleet, with increase of discharge during attacks of acidity, is often largely dependent on gout, as also is herpes or eczema about the glans, often

* *Loc. cit.*, p. 354.

recurring, and producing a bright-red, florid, or bluish and shining surface. So, again, is the frequent occurrence of erections, unassociated with sexual feeling, and especially troublesome during attacks of acidity or indigestion.

The nervous system.—Gouty persons are subject to various neuralgias—sciatica, lumbago, etc., sudden and fitful, and provoked by indigestion. Neuralgia of the heel, external ear, tongue, palate, and fingers is often gouty. So are burnings, numbnesses, and tinglings in various parts of the surface; or the fingers and toes often “die” and become white, and then flush and are hot; or there is numbness of a limb, as if it were asleep; or there are “pins and needles.” Cramps, especially in the legs and feet at night, are frequent; so are catching of the muscles, with a sudden feeling of stiffness, and pain after too long exercise. These are felt in the neck as sudden cricks, or in the loin, and are often followed by stiff-neck or lumbago lasting several days.

The skin.—In gouty persons the skin is liable to eczema, psoriasis, and urticaria, and is very susceptible to irritation. The eruption, of whatever kind, comes out suddenly and without apparent cause, or often after some known error of diet. Eczema is the most frequent, and often leads, by weakening the skin, to the gouty eczematous ulcer.

Treatment of acute articular gout.—*Local.* Position is very important. The joint should be placed in a posture favourable to the return of venous blood. When the knee or the ankle is affected, the limb must be kept in a raised position. When the elbow is attacked, the arm must be supported on a pillow or in a sling. When the wrist is involved, the forearm should be placed on a well-padded splint, circular constriction above being carefully avoided. Though the acute character of the inflammatory pro-

cess seems to suggest the local abstraction of blood by leeches, authorities are very generally opposed to this method, on the ground that experience has shown that local depletion appears to favour the deposit of biurate of soda in the tissues, with the result that the ligaments become rigid, and the joints stiffened or even ankylosed. Sir Alfred Garrod—and we could listen to no higher authority—says: “I can with confidence warn those engaged in the treatment of acutely inflamed gouty joints never to resort to this mode of combating the disease.” When the pain is only moderate, the joint should be covered with a thin layer of dry cotton wool, kept in place with a lightly-applied bandage; or a warm lotion containing 1 grain of atropine, 8 grains of the hydrochlorate of morphine, and 2 drachms of spirit, in 1 ounce of water, may be applied on lint covered with oiled silk. Sometimes a solution of bicarbonate of soda with tincture of opium, applied warm, gives relief; or either a mixture of belladonna and opium or a lotion of lead and opium may be used: A lotion of lithia, 5 grains to the ounce, is a useful solvent of chalk-stones exposed by ulceration of the skin. In chronic gout the local treatment to be adopted is that which is described in the section on Chronic Rheumatism (p. 178). Recently the new and valuable treatment of cataphoresis has been brought to our notice by Lewis Jones and others. Drugs are thereby introduced locally through the skin by means of electric osmosis. The joint to be treated is kept moist with lithium carbonate or bicarbonate of potash, and the positive pole applied to it, while a large negative pole is applied to the body. Some success has been obtained in the treatment of chronic gout by this means.

General treatment.—Three or four grains of blue pill should be given at night, and be followed in the morning by sulphate of magnesia sufficient to act as a

laxative without producing violent purging. Later on, a pill containing euonymin, or podophyllin, colocynth, and hyosecyamus, may be used (Luff). Colchicum should be given, but with caution, on account of its depressing effects, and it should be discontinued as soon as the pain has been relieved. The influence which colchicum undoubtedly has on gout, especially in its acute form, is due, according to Luff, to the fact that it diminishes the production of uric acid.* The preparations most in favour are the tinctura colchici seminum, which may be given in doses of from 15 to 25 minims, or the acetous extract, of which the dose is from 1 to 2 grains, every six hours. Often, in subacute gout, a pill containing 1 grain of this extract may be usefully given each night at bed-time. The salts of lithium are held in high repute, and owe their efficacy to the fact that urate of lithium is more soluble than that of either potash or sodium. Either from 3 to 6 grains of the carbonate or from 5 to 10 grains of the citrate (the latter salt is to be preferred) may be given twice or three times a day in potash water, or in a draught with 10 or 15 grains of citrate of potash ; or a tumbler of liquor lithiæ effervescens may be given twice or three times a day. Alkalis, in the form of either the bicarbonate or the citrate of potash (15 grains of the one or 20 of the other), every six hours, are useful to correct acidity, and to aid in the elimination of the urates and of uric acid. In cases of asthenic gout, in which the patient is pale and feeble, quinine or the compound tincture of bark is beneficial. Guaiacum, formerly much in use, has of late years fallen somewhat into disrepute. In chronic cases, however, it appears to have a good effect, and it certainly should be tried in obstinate forms of the disease.

Gout is so largely dependent on faulty digestion and

* *Loc. cit.*, p. 209.

assimilation that diet is of the first importance. The individual's capacity of digestion must always be considered. Malt liquors and almost every form of wine should be given up ; champagne is particularly harmful. But many gouty persons may with impunity, or even with advantage, take a small quantity of sound port which has been kept in wood. Well-matured whisky in small quantity (an ounce) freely diluted with mineral water is probably the safest form in which alcohol can be used. Sugars and sweet dishes should be avoided, and starchy foods should be limited. Potatoes should be taken sparingly, preferably mixed with butter (fats may be freely allowed). Well-cooked meat of good quality may be used, but not more often than once a day, and then not in large quantity. Fish, poultry, game, and fresh vegetables are suitable. Sweet fruits are detrimental. Patients who can digest milk may take it freely. In some cases a diet consisting entirely of milk may be used for a time with great benefit.* A tumbler of hot water may be usefully taken either early in the morning or at meals, or a drink made by dissolving a drachm of potassium bicarbonate in a pint of water to which are added a little lemon-juice and sugar.

* Some physicians advocate a purin-free diet, to limit the production of uric acid. Such a diet permits milk, butter, cheese, nuts, fruit, and white bread.

CHAPTER XII

CHARCOT'S DISEASE OF JOINTS

IN 1868, Professor Charcot gave a lecture on the relation between certain forms of joint-disease and *tabes dorsalis* (locomotor ataxia). Many were at first sceptical as to the truth of Charcot's observations; but this feeling has long since passed away, and the connection between *tabes dorsalis* and the joint-affection now to be described has been conclusively established.

Symptoms of *tabes dorsalis*.—The symptoms of *tabes* are very varied; yet some of them are so constant that a diagnosis can generally be made even in an early stage of the disease. The "lightning" pains—i.e. sudden flashing or lancinating pains, occurring in paroxysms, usually in the lower limbs—are often the first symptom that attracts the patient's attention. Loss of the deep reflexes, of the knee-jerk in particular, and reflex iridoplegia (Argyll-Robertson pupil), a condition in which the pupils, though acting normally in other ways, fail to contract under the stimulus of light, are two other symptoms frequently to be found in quite an early stage. From the combination of these three symptoms the diagnosis of *tabes* can usually be made; indeed, the combination of the last two (absence of knee-jerk and reflex iridoplegia) is almost unknown save in *tabes* and general paralysis. Transient squint and difficulties of micturition are also common in early *tabes*. In some cases other symptoms, of very various kinds, may occur either before or after the complaint is well developed. Such are gastric crises—that is, cause-

less and paroxysmal attacks of vomiting, often associated with lightning pains in the epigastrium; loss of sexual power; atrophy of the optic nerves; paralysis of the abductor muscles of the larynx; perforating ulcer of the foot; and the joint-disease with which we are now specially concerned. When such symptoms present themselves in a patient whose gait is not affected, the condition of the knee-jerks and of the pupils should be carefully investigated. It may be that he has tabes, but is not yet ataxic. The progress of the disease brings further symptoms; one of these is anæsthesia, which may be obvious to the patient, or may require medical examination for its detection, since the sense of touch is not always the first to be affected.

The other symptom is inco-ordination of movement (long thought to be the characteristic feature of the disease, and from which the disease was named "locomotor ataxia"). This begins, as a rule, in the lower limbs, and is manifested first as unsteadiness in walking (particularly in the dark), unsteadiness in standing when the feet are placed together and the eyes are shut (Romberg's sign), difficulty in turning, or in starting to run; next, as irregular flourishing movements of the feet and legs while walking; lastly, as a complete inability either to walk or to stand.

A remarkable complication of tabes is that of perforating ulcer, a disease which is met with chiefly in the sole of the foot, and which, commencing on the surface, often under the ball of the great toe, spreads inwards to the deeper structures until in many cases the metatarsophalangeal and other joints of the toes, or of the tarsus, are reached and destroyed. Perforating ulcer is especially frequent in cases in which arthropathies and fractures are also present. It seems probable that these ulcers may originate in one of two ways—either as fistulæ resulting from carious bone, or as a sequel to a

Painful

neglected injury of an insensitive part, the ulcer finally reaching and eroding the bone.

A general view of Charcot's disease of the joints will be obtained from the following cases, which have been under the care of different members of the staff of St. Bartholomew's Hospital, or are abridged from Baker's paper :*—

Case 1.—A woman, aged 54, seen in 1883, had disease of the right elbow and both hip-joints, with symptoms of advanced tabes dorsalis. The notes state that her illness began about twenty years before, when she had lightning pains in the legs. These have persisted, and are now more constant and more severe. Soon after, boring pains, as if a hot skewer was thrust into the flesh, set in. At first these were confined to the vicinity of the hip- and knee-joints, but they now extend to the legs, and occasionally to the body, and are very severe. About the same time she had a sensation of constriction around the waist, thighs, and legs. This was at first occasional, but now is almost constant. Many years ago she had diplopia, and of late her vision has been very defective, and not benefited by glasses; she has muscæ, and objects appear very misty. Ataxic symptoms began eighteen years ago. Her feet, from impaired sensation, felt as if "wrapped in something soft." Movements were tremulous, and rapidly became impaired, so that she could only walk across the road with difficulty, and was obliged to watch her feet. She could not walk or stand in the dark. At present she cannot lie down unless a light is burning in the room. Seventeen years ago she was under Dr. Wilks and Dr. Habershon in Guy's Hospital, and was said to be suffering from paraplegia, having lost motion and sensation in both legs. She partially recovered from this, but for eight years was unable to use her legs. While in Guy's Hospital she had severe and obstinate vomiting, but no violent abdominal pains.

Present condition.—Patient is anæmic and very debilitated; pupils are small, and do not respond to the stimulus of light, but react to accommodation. Occasionally she has violent headaches, and neuralgic pains shooting through the lower jaw and temporal region. She has constant pain in the epigastrium, occasionally extremely acute, and at times attended with vomiting, the "crisis" lasting several days. She has also boring and

* *Clin. Soc. Trans.*, xviii. 44.

lancinating pains, and a sense of constriction in the abdomen. She has scarcely any power in the lower extremities. Tactile sensation is much impaired. There is no patellar reflex and no ankle clonus. There is sometimes involuntary micturition, sometimes difficulty in micturition and in defæcation; occasionally she has forcing pains in the bladder and rectum. The bowels seldom act without medicine.

Joints.—The right elbow is four and a half inches larger in circumference than the left, and has a roughly globular outline. It is tense and elastic from the presence of effusion. The synovial membrane is considerably thickened. There is grating on movement, and the joint is loose and admits of abnormal motion, both in a lateral and an antero-posterior direction. Motion is unattended with pain. Hard nodules form part of the enlargement, especially on the inner aspect. The joint feels as if scarcely held together at all by ligaments; but the patient is able to bend and extend it almost perfectly, although with creaking and grating. Sometimes there is a momentary lock, but then suddenly the joint surfaces slip again. Sensation is defective in the little, and on the ulnar side of the ring-finger. The elbow became affected a year ago, after a slight injury. The hips present the same loose, flail-like condition that exists in the elbow. The trochanters lie an inch above the anterior iliac spines; but they can be pulled down to their normal level, only, however, to be drawn up again by the muscles when extension is removed. The joints grate on movement. The head and neck of both thigh-bones seem to have entirely disappeared. No nodular deposits of bone can be felt. The hip-joints have been affected for many years; like the elbow, they are free from pain. The great toe of the right foot is shorter by an inch than the left; the metatarso-phalangeal joint moves freely, but with distinct grating. Three scars are visible on the toe, left after the healing of three perforating ulcers, which closed three years ago under the influence of rest and dressings.

Case 2.—A man, aged 56, was admitted in 1884, under Mr. Baker. He had had good health all his life, and denied that he had ever suffered from syphilis. Two years previously he severely twisted his right knee. The joint at once began to swell, and he walked with great difficulty. Three weeks later, though he had kept his bed, the knee was still swollen; but he could bend it and walk without much pain. Three months after the accident he went to a bone setter, who moved the joint about, once a fortnight. He went next to the London

Hospital, where the joint was placed on a splint and covered with an indiarubber bandage.

Present condition.—The right knee is much swollen and distorted, and three inches and a half larger than the left. The internal condyle of the femur, though preserving its normal shape, gives the idea of being enlarged and of projecting downwards and inwards, and of not resting at all on the inner half of the head of the tibia, which has apparently been absorbed.

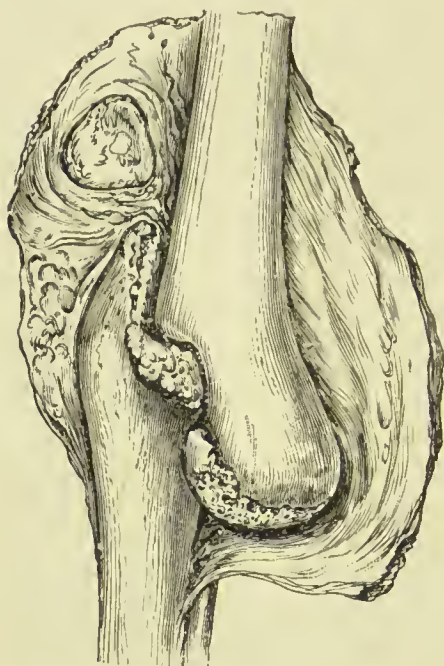


Fig. 26.—Baker's case of Charcot's disease of the right knee-joint.

(From a specimen, No. 691B, in St. Bartholomew's Hosp. Mus.)

The external condyle has almost disappeared, and in its place can be felt a semi-detached rounded nodule of bone, freely movable, and about the size of a walnut. The outer half of the head of the tibia seems to take the place of the wasted external condyle of the femur, and projects about four inches higher than the internal condyle of that bone. The joint is very loose and flail-like, so that the leg can be widely bent outwards and inwards, and also hyper-extended on the thigh. Grating accompanies any movement. The patient suffers no pain in the joint. Beneath the right great toe is a small perforating ulcer an inch in depth. In both legs

sensation is impaired. There is no tendon-reflex or ankle-clonus. The patient has had lightning pains in all parts of his body. The pupils are contracted, and do not act to light; they contract further when near objects are looked at.

During Mr. Baker's absence from London the great toe was amputated, and the patient died of septicæmia.

On examination of the knee, the synovial membrane was found much thickened. The external condyle of the femur (Figs. 26 and 27) had almost disappeared, and was represented by two

nodules of bone, together as large as a chestnut, which were embedded in the thickened synovial membrane. The internal condyle was flattened laterally, and deeply grooved from contact with the head of the tibia. At the back of the condyle was a large bony mass, lodged in a cup-like cavity in the head of the tibia. The inner part of the head of the tibia was completely worn away by the internal condyle of the femur, while the outer side took the place of the lost external femoral condyle (Fig. 26). To such an extent had this change occurred that the line of the tibio-femoral articulation, instead of being nearly horizontal, was al-

most vertical, while the only part of the bones which could serve as a support in walking was the narrow ridge on the femur, which rested on a correspondingly narrow surface of the tibia. The surface of the bones exposed by the eroding process was, for the most part, smooth and hard, but in places the cancellous tissue was exposed (*see* Fig. 27). The cartilages had almost entirely disappeared, but here and there patches were still seen; these

had undergone fibrous degeneration. The patella was thickened and irregular, and its cartilage was fibrillated. The synovial membrane presented numerous villous growths; some of these were calcareous, while others were still soft. The development of osteophytes had taken place to a remarkable extent. Nodules were scattered throughout the tissue around the ligamentum patellæ, and in various parts of the synovial membrane. The edge of the head of the tibia was covered by irregular overhanging "lips" or ridges of bone exactly resembling those found in osteo-arthritis. At a distance of about

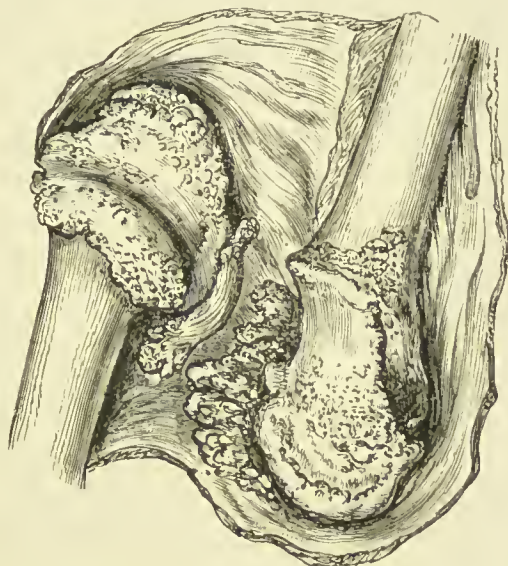


Fig. 27.—Baker's case of Charcot's disease of the knee-joint.

(From a specimen, No. 691B, in St. Bartholomew's Hosp. Mus.)

four inches from the joint both the femur and tibia appeared perfectly normal.

Case 3.—The following case, recorded by Dr. Ormerod, illustrates well the sudden onset of Chareot's disease of the knee by a rapid painless effusion.

H. S., a mason, 47, an out-patient at Queen Square Hospital. When first seen in August there were well-marked inco-ordination of the legs and anæsthesia of the feet ; absence of patellar tendon reflexes ; small, unequal pupils, contracting neither to light nor to accommodation. He had felt tightness round the abdomen for eighteen months, shooting pains only a few months. He had been subject for four or five months to attacks of vomiting, lasting two or three days, and recurring about once a fortnight. There was enlargement of the metatarso-phalangeal joint of the left great toe.

On October 19th he came complaining of his right knee-joint. Ten days previously, on rising in the morning, he noticed a large painless swelling in the knee. The joint is now greatly distended with fluid, bulging on either side of the patella and for some inches above it. There is no redness, heat, or tenderness. There is no crepitus or grating felt on manipulation.

During the next fortnight the swelling subsided a little, and a month later the joint again became greatly distended.

Six months later the effusion had subsided, and there remained thickening both of the bones and the synovial membrane ; extensive crepitus could be felt on movement, but there was no pain. In other respects the nervous disease advanced rapidly ; the inco-ordination became extreme, there was failing sight, and well-marked cystic atrophy.

Diagnosis.—On analysis, it is seen that these cases are formed of two elements, disease of the central nervous system, and an affection of the joints. The evidence of disease of the nerve-centres varies considerably in different instances. Affection of the joints may commence so early that the condition of the nervous system may easily escape notice, and in many cases the joint-changes precede the onset of ataxia. On the presence or absence of the three early symptoms, as enumerated on page 200, must a diagnosis of tabes rest. The affection of the joints, both in its symptoms

and its morbid anatomy, bears so close a resemblance to osteo-arthritis that many observers formerly maintained that they are one and the same disease. Thus in Charcot's disease, as in osteo-arthritis, the joints attacked become enlarged, sometimes by succulent thickening of the synovial membrane, sometimes by collections of synovial fluid mixed with turbid, flaky, serous exudation. Sometimes periarticular collections, or cysts, are developed. The articular borders become lipped, and the joints may be deformed by the growth of adventitious bone about the articular ends. Grating or creaking is often felt on movement. Probably the knee is most commonly affected, but all the joints, even the small joints of the hand and foot, are liable to be involved.

It is usually, in regard to the joints themselves, only in the later stages of Charcot's disease that any striking divergence from the symptoms and general course of arthritis deformans is observed. This divergence, however, is clearly marked when a joint becomes disorganised by the wide destruction of its ligaments and the articular ends of the bones, and when great deformity and wide displacement of the bones on each other occur; and when, moreover, it is observed that, although such very extensive changes have taken place, the patient still uses the limb, and has but slight pain, or, as is often the case, no pain at all, in the joint. In exceptional instances, as in Case 3, however, the early stage is more characteristic. The joint-affection, beginning suddenly with a large effusion into the synovial cavity and oedema of the limb, makes such rapid progress that in the course of five or six weeks the destruction of the articulation and of the adjacent ends of the bones is complete (see Fig. 28). Thus it is seen that the clinical features observed in Charcot's disease, though they bear originally a close resemblance to those of

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arthritis deformans, frequently transcend, both in their ultimate extent and in the rapidity with which they may be developed, anything that is met with in the latter affection.



Fig. 23.—Charcot's disease of the knee-joint with hydrarthrosis.

The specimen shows great distension of the synovial membrane, extensive destruction of the articular surfaces, and complete destruction of the interosseous ligaments. It is clear that during life the tibia had been displaced backwards, so that the main wear and tear took place between the front of its articular surface and the back of that of the femur.

(From a specimen, No. 619F, in St. Bartholomew's Hosp. Mus.)

When the joints are dissected, the appearances disclosed fully explain the clinical features of these cases.

The synovial membrane is, in the early stage, just as in arthritis deformans, thickened, and its fringes are enlarged and thickly set with tufts and villous processes. The cartilages, at first the seat of fibrous degeneration, are at length, like the synovial membrane, entirely destroyed, so that no trace, or only a small patch here and there, remains. The ligaments become softened and loosened from their attachments, and then completely disappear. The ends of the bones, as the cartilage is lost, are exposed, and worn down where they are subject to pressure, while around their borders, and in other situations where no pressure takes effect, irregular osteophytic masses are developed. By these changes the remarkable condition shown in Figs. 26 and 27 is produced. However the process of disintegration in Charcot's disease is brought about, it evidently consists of two factors: (a) excessive waste, amounting, in parts exposed to the mechanical agency of pressure and friction, to complete wrecking of all the structures concerned, and to such an amount of interstitial disintegration, or degeneration of texture, that spontaneous fracture is by no means rare;* (b) hypertrophy and reproduction, leading, by the heaping-up of new tissue, to "lipping," and to the accumulation of irregular masses of ill-formed bone about the confines of the joint.

In the great majority of instances in which the peculiar changes met with in a well-marked case of Charcot's disease of the joints are developed, the patient is found to present distinct evidence, when critically examined, of disease of the nervous system (p. 201). In other words, the symptoms of tabes very generally precede or accompany the joint-affection. Cases are, however, sometimes met with in which the joint-disease is present before any symptom of nerve-disorder can be

* *Vide* a case recorded by Rolleston, *Clin. Soc. Trans.*, xxxvi. 245.

single symptom detected. I have seen a patient (under the care of Sir Thomas Smith) who was suffering from an affection of the hip-joint which was indistinguishable from advanced Charcot's disease, but who had no symptom whatever of ataxia. It is certainly necessary, without falling into the absurdity of finding Charcot's disease in every case of arthritis deformans, to be on the watch in obscure examples of disease attacking a single joint—especially if the articulation, although the seat of advancing deformity, is free from pain—for the presence of tabetic trouble.

Pathology of the joint-changes in tabes.—In health the nutrition—i.e. the blood-supply—of the bones and the articular surfaces depends upon centripetal stimulation. If this is wanting, as in tabetic anæsthesia, the nutrition suffers, because the reflex regulation of the blood-supply is no longer active. In this way we may explain both the changes in the joints and the tendency to spontaneous fracture.

Treatment.—In the early stages treatment must be directed to limiting the destructive processes and to giving the joint as great a measure of stability as possible. When great distension of the capsule is present, aspiration is advisable, because the stretching and consequent atrophy of the capsule and ligaments imperil future stability. If aspiration is followed by reaccumulation, then drainage must be employed till the tendency to effusion has subsided.

At the same time a splint and light weight-extension should be applied to prevent interosseous pressure. When the effusion has subsided the joint should be immobilised, by means of plaster-of-Paris or a leather splint, in good position, in the hope that, with rest, new bone may be deposited in such a manner as to give support to the joint. Subsequently some orthopædic apparatus should be worn, so constructed as to allow

the patient the use of the limb, but at the same time relieve the joint of the full weight of the body, and thus prevent deformity. In early cases, should there be evidence, or even a suspicion, of constitutional syphilis, iodide of potassium or mercury should be given. If gout or rheumatism is present, it must be treated. A caution must be given against the performance of amputation. If ventured upon, this operation is very likely to be attended with an unfavourable result. Excision is equally to be avoided. In neither case can sound repair be anticipated. For a notice of Charcot's disease in the different joints, see the chapters on Diseases of the Shoulder, Elbow, etc.

CHAPTER XIII

THE JOINTS IN SYRINGOMYELIA

SYRINGOMYELIA was first described by Étienne in 1846 as a pathological condition discovered in the spinal cord of bodies after death, but it was not until 1887 that Schultz and Kahler, by identifying this condition as the cause of certain clinical manifestations, made the diagnosis of the disease possible during life.

Morbid anatomy.—The morbid changes in the joints and bones met with in syringomyelia are very similar to those occurring in locomotor ataxia, in spite of the marked differences which exist in the lesions of the two disorders. Syringomyelia is characterised by a destruction of the grey matter of the spinal cord through the development of gliomatous tissue around the central canal, and by the formation of an elongated, irregularly-shaped cavity in this tissue.

The nature of the cavities has not been fully determined, but the trend of opinion is that they originate in a gliomatosis, or overgrowth of neuroglia, which undergoes liquefaction in its central parts so as to form one or more cavities with smooth walls, and containing a clear or turbid fluid. A hæmorrhage, instead of becoming absorbed, may remain as a hæmatoma or a cyst, or there may be a dilatation of the central canal, just as there may be of the ventricles of the brain, constituting a hydromyelia.

In cases of gliomatosis, the cavities are formed in the grey matter in close proximity to the central canal, with which they sometimes communicate, and

they then spread in various directions in the deeper parts of the cord, which may, in extreme cases, be converted throughout part of its length into an elongated cyst, so much of the nervous tissue as survives being crushed into its walls.

The disease is usually situated in the cervico-dorsal region, but it may extend throughout the whole length of the cord; in exceptional cases it may involve the lumbar enlargement only. The grey commissure and posterior horns are first affected, then the anterior cornua are involved, and eventually the white matter may become the seat of ascending and descending degenerative changes.

Symptoms.—The cardinal symptoms of syringomyelia are altered sensibility, muscular atrophy, and trophic lesions. The sensory symptoms include the impairment or loss of the perception of pain, heat, and cold; but the tactile sense, the muscular sense, and the special senses are preserved. Muscular atrophy is generally observed in the small muscles of the hand or forearm, though it may extend to the shoulder and trunk, as in progressive muscular atrophy. Trophic lesions of the integuments, such as bullous eruptions, ulcers, and whitlows, are not uncommon, while the effects of disturbed nutrition upon the finger-nails may be very striking.

Articular changes.—The large joints of the upper extremity are those usually affected, no doubt because the spinal lesion most commonly involves the cervical enlargement and the upper dorsal region of the cord. In 100 examples of arthropathy due to syringomyelia the distribution of the disease was as follows: Shoulder, 32; elbow, 24; wrist, 18; hip, 4; knee, 7; tarsus, 7; and other joints, 8—that is, 74 per cent. in the upper, and 18 per cent. in the lower extremity, or in the proportion of four to one. On the other hand, 76 to

80 per cent. of the joints affected in locomotor ataxy belong to the lower extremity. Arthropathy is present in nearly one-third of all the cases of syringomyelia; and of these patients three-fourths are men, possibly because they are more liable than women to accidents and injurious influences in the course of their work.

Two forms of joint-disease are met with, the hypertrophic and the atrophic varieties. In the hypertrophic form the articular surfaces of the bones are deprived of their cartilage and the exposed osseous tissue is worn down; but at the margins of these surfaces the cartilage is much thickened, and the ends of the bones are irregularly enlarged by the formation of osteophytes. The capsule of the joint is dilated, and thickened by large deposits of bony or calcareous material; and its inner surface is beset with polypoid outgrowths of the synovial membrane. These pedunculated bodies may be very abundant and occupy much of the cavity of the joint. Sometimes they become detached and lie free in the joint. Along with the wearing away of the articular end of the bone there is often a marked production of new bone upon the adjacent part of the shaft, in the form either of exostoses or of a general thickening of the diaphysis by an osteoplastic periostitis. Moreover, the attachments of tendons, ligaments, and fasciæ near the joint are liable to become ossified. In syringomyelia, as in tabes, the bones exhibit a predisposition to spontaneous fracture. When the fractures are intra-capsular the displacement of the broken ends may lead to extreme deformity of the joint.

The atrophic variety of arthropathy is distinguished by rarefaction of the cancellous tissue and more extensive destruction of the articular extremities of the bones. At the same time there is little or no formation of new osseous tissue. In the shoulder-joint, for example, the glenoid cavity and the neck of the scapula are com-

pletely removed, the head of the humerus is worn away, and the atrophied upper end of the shaft plays upon the root of the coracoid process. In this manner the humerus may be reduced in length by several inches. The affected bones are exceptionally smooth, and light from wasting. Yet the tendency to ossification in the adjacent ends of muscles, such as the triceps in the case of disease of the shoulder or elbow, may still be present.

Clinical course.—The onset of the disease is often marked by a sudden, rapid, and almost painless effusion into the cavity of the joint, but without redness or heat. There may be a considerable amount of exudation into the soft tissues around the joint, which do not pit on pressure, and perhaps œdema of the parts beyond through interference with the venous circulation. By recurrent attacks of swelling, or through persistence of the original effusion, the capsule of the joint becomes relaxed, the ligaments soften, and a subluxation or spontaneous dislocation may take place, especially in the shoulder. The joint continues to enlarge in the hypertrophic form, osteophytes are developed, and much deformity may result from excessive destruction of the ends of the bones, or from an intra-capsular fracture, or the separation of an epiphysis in a young subject.

In consequence of septic infection taking place from the trophic ulcers in the integuments, the diseased-joint is more liable to suppurate in syringomyelia than in tabes. This complication usually develops in connection with the joints of the hand or of the foot. The bones become carious and necrosed, and a rapid formation of pus takes place. As the condition is unattended with pain, operations for the removal of the sequestra have been performed without an anæsthetic—indeed, in several instances by the patient himself.

The arthropathy of syringomyelia may be distinguished from Charcot's joint-disease by its usual localisation in joints of the upper extremities of males; more particularly by the peculiar sensory, motor, and trophic symptoms already mentioned. Scoliosis of the spinal column, possibly due to arthropathy of the vertebral joints, has been observed in nearly half the cases of syringomyelia. It does not occur in locomotor ataxy.

The following are brief notes of a case seen at St. Bartholomew's :*—

A hawker, aged 20, sustained an injury (probably rupture of some muscular fibres) to his shoulder one year previously, followed by swelling which gradually subsided. Four months later a sudden painless effusion occurred in the same joint, and two months afterwards well-marked grating was observed.

Condition on examination.—Marked uniform enlargement of the left shoulder-joint. Excessively free movement, accompanied with grating, but no pain. With the arms dependent there was one inch of lengthening, due to excessive laxity of the capsule. The grip was weaker on the affected side. In addition there was well-marked dorsal kyphosis and a dorsal lateral curve with its convexity to the left.

The other evidences of syringomyelia were: excessive secretion of sweat on the face; numerous painless ulcers on the thumb and fingers of the left hand, commencing as bullæ; complete thermo-anæsthesia from the fifth cervical to the third lumbar spine; analgesia over the front and lateral aspects of the shoulder-joint, and slightly also over the left hand. The tactile sense was normal; there was no loss of muscular pressure or localisation senses, nor were there ocular changes; but the knee-jerks were excessive.

Treatment.—The treatment of these cases should be conducted on the lines laid down for Charcot's disease of joints.

* *Clin. Soc. Trans.*, xxxv.

CHAPTER XIV

THE JOINTS IN HÆMOPHILIA

HÆMOPHILIA, according to the valuable researches of Dr. J. Wickham Legg and other observers, is met with in England chiefly, though not exclusively, in individuals of German descent, and is confined to males. Female members of bleeding families, though they frequently transmit the affection to their male offspring, do not themselves suffer from it. The main character, I may remind the reader, of the condition is that its victims, who are often termed "bleeders," are liable, as the result of a wound, or even a slight abrasion, to continuous oozing of blood from the broken surface, which it may be difficult or impossible to arrest.

They are subject also to obstinate spontaneous hæmorrhages from the various cavities that are lined with mucous membrane, namely, the interior of the nose, the mouth, the lungs, the stomach, and the intestinal canal (the blood being either vomited or passed by the bowel), and from the kidney and bladder. Bleeding may also occur into the subcutaneous tissues or the intermuscular spaces of the trunk or limbs. Though the sufferers from this affection are sometimes brought to death's door by the large hæmorrhages that recur at varying intervals, it may be of several years, the bleeding usually at length is arrested. Yet many fatal cases have been recorded. An example is related by Dr. Legg,* in which a boy, aged 13, died in St. Bartholomew's Hospital of epistaxis, hæmorrhage having persisted for five days, in spite of

* *Trans. Path. Soc.*, xxxvi. 488.

plugging the nasal cavity, and all other means that could be thought of to arrest it.

It is in the course of this formidable condition that the large joints may be the seat of hæmorrhage into their synovial cavities, either spontaneous, or resulting from an injury, such as a blow or a wrench. The knee, elbow, and ankle, as far as I have seen, are the articulations most often involved. In the case above mentioned, Dr. Legg has given a description of the condition of the two knees and the left ankle, which I copy *in extenso*, as it affords the best account of this kind of articular hæmorrhage that I am acquainted with: "The changes in the joints differ in degree, so that the ankle shows the earliest, and the right knee the more advanced, effects of the disease. Fresh, dark blood, with a small amount of clot, is found in the ankle, without any structural change in the joint: the cartilage is pink from post-mortem staining. In the left knee no recent blood is found; but its traces are seen in the deep russet-brown colour of the lining membrane. The cartilages preserve their pearly-white aspect. At the under-surface of the external femoral condyle, where it meets the pressure of the tibia, the cartilage is worn, thin, and granular over a space of half an inch in diameter. The ligaments are unaltered. In the right knee the connective tissue of the joint is also deeply stained of a brown colour; but the changes in the cartilage are far more advanced. The cartilage is wanting over the points of pressure, and bone thinly covered by cartilage has developed at the periphery of the joint. At the under-surface of the femoral condyle about the central parts, the cartilage is thin, worn, and rough. It is fissured in various directions, and laminated. It has lost its close attachment to the bone, so that a knife can be passed beneath it here and there for the distance of two or three lines. The edges of this partly detached

cartilage, when raised, are seen to be ragged and fibrous, and split into layers like that in the joint of osteo-arthritis. Around each condyle is a prominent bit of bone, somewhat nodular, and thinly covered with cartilage. The same description holds good for the articular surfaces of the tibia and patella. In the femur there is a gap in the cartilage of the external condyle on its front surface. The gap extends to the bone. The edges of the cartilage bounding the gap are smooth and rounded. Mr. Bowlby reported that, under the microscope, the cartilage showed fibroid degeneration of the hyaline matrix, with multiplication of the cells and breaking up of their capsules. The minute, like the grosser, changes bore a marked resemblance to the alterations which take place in osteo-arthritis." The joints are in the museum of St. Bartholomew's Hospital (No. 740, B, C, D), and there is a microscopic section of the cartilage (Series IV., No. 86).

In the case of Charles S——,* a boy of 9, apparently of pure Irish descent, who was under the care of Sir Thomas Smith, in St. Bartholomew's Hospital, in 1881, and who died of hæmorrhage from a slight wound of the lip, Dr. Legg reported that there had been swelling of the right knee when the boy was a year and nine months old, which had subsequently remained more or less marked. When the boy was six, his ankle suddenly became swollen, and an incision made, in one of the London hospitals, to which he was taken, was followed by bleeding for a week.

On post-mortem examination the knee was found to be slightly flexed. The patella was fixed to the front of the femur by a slight adhesion; the cartilage on the patella had been absorbed and replaced by fibrous tissue. The synovial membrane was stained of a yellowish-brown or faint saffron colour. The ends of the bones,

* *Trans. Path. Soc.*, xxxiii. 412.

where not covered with cartilage, were tinted in like manner. (Plate 5.) A similar condition was found in the right ankle.

These cases show that the joint-affections met with in hæmophilia are the result, primarily, of synovial hæmorrhages.* These hæmorrhages produce more or less articular swelling (which, though it usually slowly subsides, is sometimes permanent), and are followed by a low form of inflammation and the development of adhesions, by which movement is interfered with, or entirely prevented; and also by degenerative processes, consisting of fibrillation and absorption of the cartilage, and other changes closely resembling in their morbid anatomy those met with in osteo-arthritis. In some instances the joints became considerably deformed.

Symptoms.—While bleeding is already taking place elsewhere, or as the first event in a hæmorrhagic attack, one of the joints (the knee is a convenient example) is found to be the seat of a suddenly developed enlargement, sometimes only amounting to a slight puffy swelling, but often distinctly fluctuating, and evidently caused by fluid in the synovial cavity. There is little increase of heat, but the joint is often painful on movement, and tender, as if affected with subacute rheumatism. Subsequently the swelling gradually subsides, and the joint may entirely recover; but in many cases puffiness and stiffness, varying in amount in different cases, remain, and are accompanied by frequently relapsing pain and tenderness, which prevent the patient from walking. In some instances the joints become more and more impaired, and crippled, by repeated hæmorrhages and the changes to which these give rise, and deformity may be slowly developed.

* Sir Almroth Wright states that the effusion into the joints consists of clear lymph which sometimes contains an admixture of blood-cells—"serous hæmorrhages."



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PLATE 5.—HÆMOPHILIC KNEE.

Treatment.—In respect of treatment, the importance of recognising the nature of these cases must first be pointed out. An oversight may lead to a fatal result. Indeed, Poncet* records a case in which a boy, aged 8, died of hæmorrhage following the application of the actual cautery to the joint; and Charles S—— (p. 219) died at the end of a week after an incision had been made into his enlarged ankle-joint. The danger of overlooking the disease is greatest in cases in which joints have been damaged by repeated slight relapses, unattended with hæmorrhages in other parts. In the case, therefore, of male patients suffering from obscure subacute relapsing swellings of the joints, resembling subacute rheumatism or osteo-arthritis, inquiry as to the presence of hæmophilia should always be made before any proceeding involving a breach of surface, even by a blister, or any forcible manipulation for the restoration of movement is adopted. Fortunately the patients themselves (or their parents) are generally, from previous experience, so alive to the dangerous consequences of a wound or other form of injury, that they mention the fact that they are “bleeders.”

The best course is to keep the limb at rest on a splint, to apply evaporating lotions or ice, if hæmorrhage is still going on, and subsequently to cover the joint with mercurial ointment, and a Martin's indiarubber bandage not too firmly applied. Gentle frictions and massage may be used if the swelling remains indolent, but they must be used with great care, or further hæmorrhages will be provoked, and the patient should walk with a crutch or a stick, so as to avoid the chance of wrenching or spraining the joint. Aspiration of the joint, with even a fine needle, must certainly not be ventured upon, nor should blisters be used. Iodine liniment—not, however, strong enough to produce much irritation of the skin—

* *Lyon Méd.*, 1871, viii. 785, 798.

may be applied. During attacks of hæmorrhage from other parts, any joint that has already suffered ought to be scrupulously guarded against even slight mechanical injury.

Injectations of blood-serum have been strongly advocated* to diminish the tendency to bleed; 10 to 20 c.c. of fresh serum may be injected into the veins, or under the skin, and a second dose given two days later. Children should be given a half-dose. It makes no difference whether human, horse-, rabbit-, or ox-serum is used, provided it is fresh.

Gelatin is sometimes given internally, 6 oz. of a 10 per cent. solution twice a day, and is said to cause the blood to clot more rapidly. Thyroid extract in 5-grain tabloids, three times a day, may also be tried, or calcium chloride in suitable doses according to the age of the patient. Thymus extract has been employed, but without obvious benefit.

* P. E. Weil, *Rev. de Chir.*, April, 1907.

CHAPTER XV

NEW GROWTHS INVOLVING THE JOINTS

VERY important, and often very obscure, cases are those in which the question arises whether the patient is suffering from some inflammatory affection of a joint, or from a new growth. Tumours which closely imitate inflammation of a joint occasionally originate in the synovial membrane; but more commonly they are seated in the articular extremity of one of the component bones. In the latter case they spring usually from that end of the bone in which the original growth in length of the shaft mainly takes place. Hence the occasion for diagnosis between tumours and joint-disease chiefly, but by no means exclusively, presents itself in the instances of the shoulder, the wrist, and the knee.

1. New growths involving the articular ends of the bones may be either endosteal or periosteal. Both forms are most common at that end of the long bones at which growth is most active—the upper end of the humerus and the tibia, the lower end of the radius, ulna, and femur. But to this general rule there are many exceptions in which the ends opposite to these are involved. The predominant age for their appearance is between fifteen and thirty; but they may occur in early childhood or as late as the sixtieth year of life, or even, though rarely, at a still later period. As to endosteal sarcomata, the prevalent form is the myeloid, but the round-, spindle-, or mixed-celled varieties are also met with. A myeloid is of slow and often painless growth. A low-crowned swelling

gradually forms, and by degrees the whole articular end and the neighbouring part of the shaft become expanded, and the walls thinned, so that they yield here and there on pressure, and egg-shell crackling is felt. In rare instances pulsation can be detected. As growth advances and excavation takes place, walking and other movements become painful, and spontaneous fracture is prone to occur. In many instances the joint contains fluid. In the early stage, when the growth is small, and deeply placed in the mid-substance of the bone, the only symptom may be a slow enlargement of the bone, very much resembling that which is produced by tuberculous osteitis. When such a swelling is observed it should be explored by means of a small chisel and a mallet, for a myeloid should not be allowed to continue its growth; while if the affection is tuberculous, and is left to advance, inflammatory softening may extend and the joint itself be involved. If on exploration a myeloid tumour is found; its substance should be gouged away, and the walls of the cavity scraped until every trace of the growth has been removed and only hard bone is left.

This proceeding ought to be adopted instead of amputation in every case in which a firm shell will remain after enucleation and scraping. Even a thin-walled aseptic cavity will fill up, although only by a slow process of new-bone formation. As myeloids neither spread by infiltration, affect lymphatic glands, give rise to secondary deposits, nor show any marked tendency to local recurrence if they have been completely removed, amputation is not called for unless the bone has become excavated beyond hope of repair; while, should recurrence take place after a first removal, a second operation of gouging and scraping may prevent further return. This conservative course is in agreement with the view now held by many pathologists, that myeloids

should be classed not as malignant but as innocent growths.

Excision of the end of the bone when the growth is a myeloid may in appropriate instances be attended with an excellent result, in the case of the upper end of the humerus and the lower ends of the bones of the forearm. In the course of 1886, Sir W. Savory, at St. Bartholomew's Hospital, removed the upper third of the humerus for myeloid sarcoma growing within it, in a girl aged 16. The wound healed without drawback, and there was every promise that the limb would be very serviceable when the patient was discharged six weeks after the operation. A case is recorded by Mr. Lucas * in which he removed the lower half of the ulna for a myeloid tumour occupying its substance. The patient retained a useful limb. In the same volume (p. 138) Sir Henry Morris has a valuable paper, relating a case in which he removed the lower two-thirds of the radius and the lower three inches of the ulna for endosteal sarcoma of the lower part of the radius. After recovery the patient could use the limb for many purposes when it was supported in a leather case. In the same communication examples of a somewhat similar operation performed by other surgeons are referred to. In many instances the usefulness of the limb is certainly a striking feature in the result that is obtained.

Not rarely, as we have seen, endosteal growths are formed of round, spindle, or mixed cells. They are chiefly indicated by their rapid increase, by the severe pain by which they are generally accompanied, and by the appearance of a tuberos swelling or lobe when they break down or project beyond the bone on one of its aspects. A notable point about these growths is that, extending in the direction of least resistance,

* *Clin. Soc. Trans.*, x. 135.

they may spread along the medullary canal so that the shaft of the bone is occupied for the greater part of its length by the disease. I have recently seen an instance in which, in a man about 50, an endosteal sarcoma, without expanding the head of the humerus (where it originated), had extended along the medullary canal for more than two-thirds of its whole length.

A periosteal sarcoma formed of round, spindle, or mixed cells, with, in some cases, an admixture of cartilage, is of rapid growth; it soon produces considerable enlargement of the end of the bone, and usually of the adjacent part of the shaft as well, so that a third or more of its length is involved. The swelling is in some cases of uniform outline, gradually tapering as it is traced from the articular end along the shaft. In others it presents tuberos masses or lobes which make its contour bossed and irregular. The skin, at first of normal appearance, later on becomes faintly or markedly dusky, and enlarged veins are seen. Glands are affected only in very rare cases. Pain is sometimes absent or slight, sometimes marked or severe, and is aggravated by pressure (as in walking, when the disease is in the femur or tibia) or other disturbance. The surface of the swelling may be over-warm, and the temperature in the mouth is raised. I have found it in actively-growing sarcoma as high as 102° , and in two instances 103° —depending, I assume, on toxin-absorption.

These periosteal sarcomata very closely resemble tuberculous osteitis so far as their clinical features are concerned, and serious mistakes can only be avoided when great care is taken. The age at which they appear, the bones involved, the rate of enlargement, the degree of pain between that which is slight and that which is severe—all these are very similar in the two affections. The chief points to bear in mind are the following: Tuberculous osteitis is distinctly more common—

at least in young subjects—than sarcoma. A smooth, uniform enlargement is more common in tuberculous disease. Sarcomata often present lobes, or an abrupt bulging limited to one aspect of the bone. In two cases a correct diagnosis of tuberculous disease was reached by the detection of a soft and very tender spot, where pus was making its way through the wall of the bone towards the surface. A radiogram should, if possible, be obtained and carefully interpreted. In sarcoma the normal outline of the compact layer of the shaft will be seen, surrounded by a growth; in tuberculous disease the bone is seen to be enlarged, and its outline is obscured by rarefaction and caseation involving its cancellous interior and its outer wall. In the later stages, when a sarcoma has broken down and hæmorrhage has occurred into its substance, a large elastic or fluctuating swelling covered with an œdematous skin may form, while the patient's temperature may be 101° or even 103° . The likeness here to a tuberculous abscess is in a high degree deceptive, and a correct diagnosis may only be possible after an exploratory operation. In such cases leave to perform amputation, if it proves necessary, should be previously obtained.

The prognosis in periosteal sarcoma is well known to be highly unfavourable. Amputation is the only resource. As to the site at which it should be performed, and the best method, the reader is referred to the standard works on operative surgery.

2. Tumours involving the synovial membrane.—*Sarcoma* commencing in the synovial membrane of a joint is probably very rare. I have seen only one example of it.

Alfred B., aged 21, was admitted to St. Bartholomew's Hospital, under my care, in September, 1892, for a swelling on the inner side of the left knee. For eighteen months he had felt pain in the knee and down the inner side of the leg. The swelling,

which had existed for fourteen months, was seated over the inner condyle of the femur, close to its articular border. It was firm and somewhat elastic, distinctly circumscribed and prominent, and about the size and shape of a small flattened Tangerine orange. The situation and physical characters of the swelling made its nature very doubtful, but it appeared most likely, on the whole, that it would prove to be due to tuberculous periostitis of the condyle of the femur, with infiltration and thickening of the adjacent structures. On cutting into it, however, I found it was a new growth entirely unconnected with the femur, and springing from the subsynovial tissue of the joint. It was freely removed by cutting it out, together with a zone of surrounding synovial membrane. By this proceeding a large opening was made into the joint on the inner side of the patella. The wound healed by primary union. On microscopic examination the swelling was found to be composed mainly of spindle, but with some admixture of round, cells.

In December, 1894, the patient was again admitted, complaining of pain in the knee. There was a good deal of muscular wasting, and the joint was somewhat stiff. No return of the growth could be found. The pain was believed to depend on adhesions, and the joint was moved under gas, with the result that the pain ceased. In March, 1895, the patient was in again with a recurrence of the pain and with limitation of movement, and a growth as big as a large marble was removed from the upper end of the original scar. This had the structure of a spindle-celled sarcoma.

In December, 1895, the patient presented himself again with a return of his pain. A nodule of growth, of the size of a small walnut, was removed from the subsynovial tissue to the outer side of the joint, the whole thickness of the synovial membrane being cut away over an area about an inch in diameter, and some of the adjacent part of the external condyle was also removed. In January, 1896, a small nodule was excised from the lower part of the original scar on the inner side of the joint, but on examination this was found to consist merely of fibrous (cicatricial) tissue; it contained no recognisable sarcomatous elements. In August, 1896, two small nodules of sarcoma were removed from the inner side of the joint; and in March, and again in October, 1897, small masses of similar structure were detected and cut out. In December, 1897, the patient came to the hospital again with what appeared to be a recurrence in the posterior part of the joint. In this situation a deep-seated swelling, apparently as big as a large walnut, could be felt pro-

jecting backwards. This had displaced the popliteal artery, so that it was pulsating close beneath the skin. There was marked muscular wasting, the knee was stiff, and the patient complained of severe pain extending down the limb. There was no affection of the femoral glands. As there was clearly a recurrence of the growth, and as the limb was now almost useless, I performed amputation through the middle of the thigh. On examination, a growth as large as a bantam's egg was found springing from the synovial membrane at the back of the joint, and there was a second but smaller process which extended forwards into the joint between the condyles. These growths, like those previously removed, presented the microscopic structure of a spindle-celled sarcoma with some small round cells here and there.

This case is a very singular one. The original disease was limited entirely to the synovial membrane, so that, as I have said, it was removed by cutting a large window in the side of the joint. It had no connection whatever with the periosteum or bony portion of the condyle of the femur, and in each recurrence it appeared to involve only the synovial membrane or the subsynovial tissue. The history of the case was remarkable. In a young adult sarcoma generally grows rapidly, shows a marked tendency to recur quickly after removal, and is often followed by secondary deposits in the internal organs. Here, however, the original disease recurred only after an interval of more than two years, and, although the disease extended, in all, over a period of more than six years, with five recurrences, no secondary deposits were developed. And the method of local recurrence was very unusual. The original growth was limited to the synovial membrane on the inner side of the joint. But after one recurrence in this situation the growth made its appearance on the outer side;—not, it appeared certain, by direct extension, for the disease had been freely removed on the inner side, and the scar there remained quite healthy; and, moreover, when the growth on the outer side was exposed it was found to

be an isolated mass, entirely limited to this situation and quite unconnected with any extension from the inner side; while after its removal no recurrence of disease ever took place on the outer side, nor was there recurrence on the inner side until nine months later. But, further, while the inner and outer parts of the joint were still free from any renewal of the growth, a mass sprang up at the posterior part of the joint, and grew backwards into the popliteal space. In fact, in the course of the six years over which the disease extended, it seemed to spring up in different districts of the synovial membrane, not by extension from its original site, but by independent developments.

Dr. Schiller, of Brisbane, has recorded a case* in which both knee-joints were attacked by *secondary carcinoma* following a hysterectomy for carcinoma two months before.

Cases have been recorded of *angiomata* involving the synovial membrane of joints. Mr. Frederick Eve† has recorded four cases which in many respects resembled tuberculous disease of the synovial membrane prior to operation.

Here it may be well to refer to the subsynovial lipomata which are sometimes met with in the larger joints, such as the knee and shoulder. A not uncommon situation is in the knee at the side of the patella, where an overgrowth of fatty tissue on the alar ligaments gives rise to a tumour projecting into the joint.

In cases of arthritis deformans a condition may be met with to which Muller has given the term "lipoma arborescens." Fringes of fat covered with synovial membrane project into the joint from the margins of the articular surfaces, closely resembling the appendices epiploicæ on the large intestine. Fig. 29 illustrates

* *Monatsschr. f. Geb. u. Gyn.*, June, 1907.

† *Brit. Med. Journ.*, May 16, 1903.

a rare condition in which a sarcoma originated in an excised knee and spread into the surrounding muscles.

Hydatid disease of the joints.—In a valuable paper Mr. Targett * has described the extension to the joints of hydatid disease involving the articular ends of the adjacent bones. This invasion establishes, Mr.

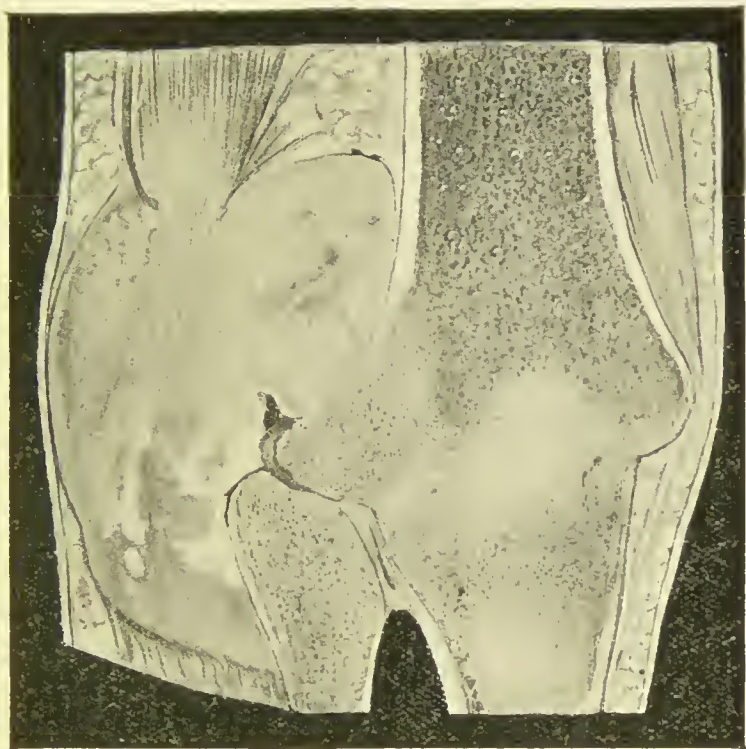


Fig. 29.—Sarcoma following excision of the knee-joint.

A spindle-celled sarcoma occupies the popliteal space, extending from the line of the excision to the skin and infiltrating the muscles. From a woman, aged 41, who had suffered from tuberculous disease of the knee for five years. One year before the date of amputation excision had been performed.

(From a specimen, 453c, in St. Bartholomew's Hosp. Mus.)

Targett points out, a grave complication, inasmuch as the disease is commonly attended with suppuration. The development of the original cyst leads to wide

* *Guy's Hosp. Repts.*, 1893, 1. 309.

destruction of the bones, the cancellous tissue is broken down, and extensive necrosis takes place. As the disease advances, the secondary cysts escape through the walls of the bone and occupy the surrounding structures and make their way into the cavity of the joint. These changes are well illustrated by a specimen of



Fig. 30.—Hydatid disease of the lower end of the femur, involving the knee-joint.

(R.C.S. Mus., No. 1,700B.)

hydatid disease of the knee-joint (No. 1,700 B and C in the museum of the College of Surgeons). The following is Mr. Targett's description of the specimen :—

The specimen consists of the ends of the bones and soft parts forming a right knee-joint. The lower end of the femur (Fig. 30) has been divided in an antero-posterior plane, and the cut surface displays a

large cavity occupying the interior of the bone immediately above its articular surface. This cavity measures nearly two inches vertically, and from before backwards, while laterally it extends into each femoral condyle, and has a width of three and a half inches. Above, it is bounded by the end of the diaphysis, which has been transversely fractured and driven into the cavity below

for the distance of an inch. Anteriorly, the space is limited by the compact tissue of the bone; posteriorly, the corresponding layer is largely replaced by dense fibrous tissue, and what actually remains of the osseous material is reduced to a thin lamella. Similarly, the outer and inner walls of the condyles are little more than a translucent shell of bone. The articular surface of the femur which forms the inferior boundary of the excavation is much destroyed. That part of the internal condyle which is in contact with the tibia has sunk into the cavity, owing to the yielding of the bone, and forms a well-defined depression, the centre of which is perforated by a circular aperture one inch in diameter. By means of this aperture the cavity in the femur freely communicates with the interior of the joint. The outer condyle, though retaining its normal outline, presents several large perforations around which the articular lamella is necrosed and partially detached. The cartilage upon the condyles has disappeared, and the bone is covered with inflammatory tissue, which is especially abundant in the crevices between the points of contact of the femur, tibia, and patella. The patella was united by fibrous adhesions to the front of the external condyle, and when separated, the corresponding area on the femur was found much eroded and in parts penetrated by the growth of cysts.

On viewing the exterior of this portion of the femur, it will be noted that the site of the fracture is marked by a deposit of new bone and callus, which projects chiefly on the posterior surface. It is also partly formed of a splinter from the lower fragment. There is close fibrous union between the fragments, allowing a slight amount of movement in front, while behind, ossification has begun. Besides the perforations in the walls of the cavity in the femur, whereby the hydatids have obtained access to the knee-joint and to the surrounding soft

parts, it would seem that the fracture of the shaft has also liberated them, for cysts are seen on the outside of the bone at the line of fracture embedded in the thickened periosteum and cellular tissue. The interior of the excavation in the femur is lined with a succulent layer of granulation-tissue, to which small spongy sequestra and numerous budding cysts are attached. Some of the latter are partially embedded in it. Where the broken end of the diaphysis projects into the cavity, the cancellous tissue and medulla are infiltrated with small hydatids, while the rest of the bone is covered with granulation-tissue. As regards contents, in the recent state the cavity was filled with thick oily pus, loose hydatid cysts, sequestra, and débris, but no hooklets were found. Many of the small sequestra have been removed, but a large one still occupies the cavity. It measures two and a quarter inches in length, is quite detached from the walls of the space, and appears to have been derived from the junction of the diaphysis with the articular extremity of the bone. It is composed entirely of cancellous tissue, and many of its superficial spaces are filled with minute cysts.

In the head of the tibia the changes, though rather less extensive, are precisely similar in character. The articular surface shows destruction of the cartilage covering the internal facet, and necrosis of the subjacent bone, a part of which being detached, a communication is established between the interior of the joint and an irregular cavity in the head of the tibia. The cartilage on the external facet is less destroyed, but through the yielding of the subjacent bone the surface is markedly depressed. At the back, near the head of the fibula, there is a small sequestrum and a passage leading into the above-mentioned cavity. There are numerous tracks of suppuration, and a few cysts among the ligaments of the joint. A vertical section of the head of

the tibia displays a wide cavity beneath the articular surface, containing a large necrosed mass of cancellous tissue, which is not yet completely detached; and in other respects it closely resembles the excavation in the femur. The soft tissues around the knee, particularly in the popliteal space, showed tracks of suppuration and various collections of pus, indicating gravitation from the joint and the cavities in the bones. Along many of the sinuses hydatids were to be seen, suggesting that the burrowing of pus might have carried the cysts into the soft parts, there to enlarge and multiply. The directions taken by the pus were precisely those met with in an ordinary suppurating knee, bursal communications and the prolongation of the synovial membrane around the popliteus tendon being made use of to reach the exterior.

Clinical history.—The patient the subject of this rare affection was a man, aged 54 years, who had received a severe injury to his knee-joint, from which he never completely recovered. He always had to use a stick afterwards, and it is probable that the femur was broken at the time of the injury. At first he noticed that the “knee-bones” gradually enlarged, then a soft swelling extended upwards to the back of the thigh. When first seen by his doctor he had a large fluctuating swelling in and above the popliteal space, an apparent enlargement of the articular ends of the femur and tibia at the knee, and distinct grating in the joint on manipulation. The swelling was tapped, and a large quantity of turbid fluid drawn off containing small vesicles, the nature of which was not suspected. The swelling refilled and was laid open freely, and most of the contents were scraped out; a communication with the knee-joint was then discovered. Suppuration ensued, and it was considered advisable to amputate the thigh a month later. The patient made a good recovery.

For further information the reader should consult Mr. Targett's paper:

As to **exostoses** occurring in the close neighbourhood of the joints, it will be enough to say that not only are they sometimes placed so close to the articular border that their removal may, unless care is taken, be attended with a wound of the synovial membrane, but they are occasionally invested by a bursa which communicates directly with the interior of the joint. Even in such cases, however, if the operation is aseptic, no serious result will follow. On the other hand, if the necessary precautions are neglected, acute arthritis will probably occur.

CHAPTER XVI

DISEASES OF BURSÆ IN THE NEIGHBOURHOOD OF JOINTS

It may be useful to introduce this subject by a brief reference to the anatomy of the bursæ near the principal joints, which are liable to become diseased, and to require surgical treatment. Their position, and the question whether they communicate with the interior of the articulation, are the two main points respecting them.

The shoulder.—1. *The subacromial.* This is a large bursa under the deltoid, which runs for some distance beneath the arch formed by the acromion and the coraco-acromial ligament. It rests on the supra- and infraspinatus muscles as they pass to be inserted into the greater tuberosity of the humerus. Though it usually does not, it nevertheless may communicate with the joint.

2. *The supra-acromial.* An adventitious bursa is sometimes formed over the acromion process in persons who carry weights on the shoulder, and is liable to become inflamed.

3. *The subscapular.* The large bursa between the subscapularis and the neck of the scapula is formed by a direct prolongation of the synovial membrane through an opening in the capsule. This bursa is said to become enlarged in some instances, and to form a swelling to be felt in the axilla.

The elbow.—1. *The olecranon bursa.* About the elbow, the bursa of most importance from a surgical

point of view is that over the olecranon. It has no connection with the joint.

2. *The subtricipital.* The bursa situated beneath the insertion of the triceps into the olecranon is usually small; but it is occasionally enlarged, so as to project upwards between the tendon and the back of the humerus. It does not communicate directly with the joint, but it is so near the capsule that great caution would be required in treating it. The diagnosis of enlargement of this bursa from disease of the joint can readily be made by noting the absence in the former of bulging between the olecranon and internal condyle when the forearm is flexed, and by observing that the normal line of depression between the back of the capitellum of the humerus and the head of the radius is not obliterated.

3. *The internal condylar bursa.* In miners, and in persons engaged in writing, whose left elbow rests on the table, and is thus subject to pressure, a bursa may form over the internal condyle. I have seen such a bursa as large as an egg.

The wrist.—The “ganglia” that occur in connection with the different tendons on the dorsal aspect are familiar to all. So also is the compound palmar ganglion, in connection with the flexor tendons. None of these communicates with the wrist-joint, but synovial herniæ from the joint may occur on the dorsal aspects of the wrist. Chassaignac* called attention to the liability of such herniæ to be mistaken for aneurysm, especially if crossed by the radial artery.

The hip.—1. *The ilio-psoas bursa.* This large bursa lies between the ilio-psoas tendon and the front of the capsule. It generally communicates with the interior of the joint, through an opening which is often of considerable size. Two cases have been seen at St. Bartholomew's Hospital—and such cases are not uncom-

* Soc. de Chir., séance d'Avril, 1845.

mon—in which this bursa formed a swelling of the size of a small orange. It protruded in both instances from beneath the inner border of the tendon of the ilio-psoas, and raised the femoral vessels so that they were placed immediately beneath the skin. In one case the hip-joint appeared healthy, in the other it was the seat of arthritis deformans.

2. *The gluteal bursæ.* The largest of these lies between the aponeurosis into which the upper part of the gluteus maximus is inserted and the great trochanter, and allows the bone to play freely on the under-surface of the muscle. It is often large and multilocular. Two other bursæ are found in connection with the gluteus maximus. One lies between the insertion of the muscle into the gluteal ridge and the tendon of the vastus externus, and the other between the muscle and the tuberosity of the ischium. The latter is interposed more between the tough superficial fascia and the bone than between the muscle and the bone. None of these communicates with the joints.

The knee.—Here are numerous bursæ. The one most often diseased is the *bursa patellæ*. It lies over the patella and the upper part of the ligamentum patellæ, and has no connection with the joint. The *subcrureus bursa*, beneath the quadriceps extensor muscle, lies just above the level of the condyles, varies much in size, and is sometimes large. It often communicates freely with the synovial cavity. The *bursa beneath the ligamentum patellæ* at its insertion into the tubercle of the tibia, though not connected, usually, with the synovial membrane, is so close to it that it must be handled very cautiously. I have seen a case in which it required surgical treatment. Posteriorly the most important bursa lies beneath the *semi-membranosus* tendon. It rests on the back of the internal tuberosity of the tibia and the inner head of

the gastrocnemius, and frequently communicates with the joint. Other bursæ are to be found beneath the heads of the gastrocnemius and over the head of the fibula beneath the tendon of the biceps. The bursa lying beneath the tendons of the sartorius, gracilis, and semitendinosus as they pass round the inner side of the head of the tibia has no connection with the articulation.

The ankle.—The only bursa constantly present is that beneath the insertion of the tendo Achillis into the back of the os calcis. It is not very rarely enlarged. It is wide of the joint. Adventitious bursæ are frequent on the dorsum of the foot in club-foot and other deformities.

The diseases to which bursæ are liable are chiefly of an inflammatory type, and are often produced by mechanical injury. In many cases, owing to repeated attacks of slight inflammation, they become considerably enlarged, and their interior becomes occupied by fibrinous exudation, as in the ordinary instance of an enlarged bursa patellæ. At the same time, owing to slow deposition and organisation of fibrin on its inner surface, the wall becomes thickened and indurated. In some instances the process gradually leads to the obliteration of the cavity of the bursa, and its conversion into what is virtually a fibrous tumour of low organisation. Sometimes the bursa remains as a thick-walled sac, containing shreds and ragged fragments of fibrin, which are gradually converted, by pressure, into "melon-seed-like bodies," and which, under the microscope, present merely a granular or dimly fibrillated structure; or the fibrin may become organised into tendinous cords or bands. In other cases bursæ become acutely inflamed, and constitute tense and very painful swellings, attended, as in the instance of the bursæ over the olecranon and the patella, with inflammation of the surrounding skin. Bursæ may also be the

seat of *tuberculous disease*, or of *acute rheumatic or gouty inflammation*. These last two affections, especially the latter, are attended with excessive pain, and entirely prevent the use of the limb. A patient, two days after he was attacked with acute gout in the right great toe, was seized with intense pain in the left heel. The bursa beneath the insertion of the tendo Achillis was acutely inflamed; the tendon itself was normal. Acute gout may also involve the bursa under the ligamentum patellæ.

Bursæ are not rarely affected with syphilitic disease: During the secondary stage an acute or subacute inflammation may occur in many of the bursæ. Effusion occurs, usually painful and frequently symmetrical, and if the cause is not recognised chronic fibrous thickening results. In the tertiary stage painless gummata rapidly form. The following is an example: A patient had a large, hard, irregularly-lobed swelling over the great trochanter of the femur, together with tertiary eruption and a node on his tibia. The swelling subsided gradually under the use of potassium iodide in 10-grain doses, and at the same time the node and the skin-eruption disappeared. In another case, that of a porter, symmetrical painless hard gummata appeared over both trochanters. Two years previously he had had a chancre and a secondary rash. The handles of the barrow which he used rubbed against his hips. Under mercury and iodide of potassium the swellings subsided. The bursæ most liable to syphilitic inflammation are, besides the subgluteal just mentioned, the bursa patellæ and those over the olecranon and the tuberosity of the ischium. If the enlargement is recent, it will subside under the influence of potassium iodide. But when the walls have become much thickened, excision is usually the best treatment. -

In an important group of cases, bursæ become distended when effusion takes place into the joints with

which they communicate, and of which they may be regarded as mere pouches or diverticula. This is best seen when the bursa under the semimembranosus in the popliteal space enlarges as fluid collects in the knee-joint. In some of these instances the condition of things is at once apparent; the joint is obviously distended, and fluctuation between the joint and the bursa can be distinctly felt. In many cases, however, the joint is so little swollen that the fact that it is involved, and that the bursa is filled from it, may be overlooked. Two cases have been seen of tuberculous disease of the knee in which the semimembranosus bursa, which communicated by a large orifice with, and was distended by synovia from, the joint, was dissected out, the cause of the enlargement having been overlooked. In cases of multiple loose cartilages in the knee-joint I have found as many as five lodged in the semimembranosus (p. 259).

Treatment.—Counter-irritation, either by blisters or the biniodide of mercury ointment, pressure, evacuation, or evacuation and pressure combined, are methods of treatment which are uncertain and often useless. In subjects whose general health is sound, and who suffer material inconvenience either from the size of the swelling or from recurring attacks of inflammation, the best course is to remove the sac—a proceeding which the aseptic method has rendered perfectly safe, and which has long been established as the routine proceeding. Should distension of a bursa, however, be secondary to disease of the joint with which it communicates and into which effusion has taken place, no operative treatment should be adopted, unless the condition of the joint demands it.

When bursæ, as the result of repeated attacks of inflammation, have become converted into what are virtually fibrous tumours, or when, though they still

form a considerable cavity, their walls are thick, they should, as the only efficient treatment, be dissected out. The operation for the removal of the bursa over the patella must be performed with care, for where the bursa projects laterally, so as to pass beyond the sides of the ligamentum patellæ, a situation in which the joint-capsule is extremely thin, the articulation will be opened if the knife is used at all freely. There is, indeed, a tradition that a surgeon, when he had completed the removal of the bursa, discovered that he had removed the patella also. In operations on bursæ it must be remembered that many are tuberculous, and that, to prevent recurrence, the main sac and its ramifications must be completely dissected out. This is well illustrated by the bursa surrounding the tendons of the sartorius, gracilis and semitendinosus as they pass round the inner side of the knee.

When bursæ are inflamed and become distended they must be opened at once. If incision is delayed when suppuration has occurred the distended sac will give way subcutaneously, and pus, unable to make its way to the surface through the thickened integument by which bursæ are generally covered, will become extravasated into the neighbouring areolar tissue and lead to widespread cellulitis. Cases are not infrequently seen in the hospitals in which, from the rupture of an inflamed and distended bursa patellæ, the whole vicinity of the knee has become the seat of diffuse suppuration, rendering extensive incisions necessary, and producing a condition from which recovery is always tedious and slow.

Should it be suspected that enlargement of a bursa is of syphilitic origin, potassium iodide, alone or in combination with mercury, should be prescribed; or, if the sac-wall is very thick, the swelling should be excised.

CHAPTER XVII

ON THE FORMATION OF CYSTS IN CONNECTION WITH THE JOINTS

THE above forms the title of two excellent papers by Morrant Baker,* in which the author describes a group of cases that had not previously attracted the attention they deserved.† “Baker’s cysts,” as they are now styled, are met with most frequently in connection with the knee-joint, but they may occur in association with the hip, shoulder, elbow, wrist, or ankle.

D’Arey Power has recorded examples in connection with all these joints. Baker at the time that he wrote believed that these cysts occurred mainly in connection with osteo-arthritis, and occasionally with tuberculous and Chareot’s disease.

In the museum of St. Bartholomew’s Hospital there are three specimens of Baker’s cysts of the knee, one of the shoulder, and one of the elbow. Recent microscopic sections of these specimens clearly show that in each case the disease was tuberculous, and it seems probable that this disease is responsible for the majority of the cases.

A remarkable feature in connection with these cysts is the remote connection which they often appear to have with the joint from which they originate (Fig. 31). Large intermuscular cysts have been met with

* *St. Bartholomew’s Hosp. Repts.*, xiii. 245, and xxi. 177.

† M. Foucher, in Paris (*Arch. Gén. de Méd.*, 1856), drew attention to a similar series of cases.

quite low down in the calf, which on dissection have been found to communicate with the knee-joint by a narrow tubular passage; and the same may occur in the case of the shoulder-joint, where a cyst may form, and burrow along the biceps tendon as far as the middle of the arm. In some cases, as the result



Fig. 31.—Cysts in connection with disease of the knee-joint, extending upwards into the thigh.

of effusion into the joint, a hernia of the synovial membrane through some weak spot in the capsule results, as in the case of sacculi in the bladder, but more often there is a distension of a bursa in normal communication with the joint—e.g. the bursa under the semimembranosus muscle—followed by a further

extension in the line of least resistance in the inter-muscular planes.

The following is a good example of a case of synovial cyst extending into the calf through the ligamentum posticum Winslowii and along the tendon of the popliteus. A patient, aged 53 (I quote from Baker's account), was admitted under Mr. Holden in 1875, having a month previously noticed a swelling in the calf of his right leg, especially prominent at the upper and inner part, three or four inches below the knee. This was punctured by the house-surgeon, under the belief that, as there had been redness and tenderness, it was an ordinary abscess in the calf. A greasy fluid, containing flakes of lymph, but no pus, escaped. Suppuration followed the puncture, and the knee-joint a few days later became tensely swollen, and, on pressure being made over the articulation, fluid escaped from the puncture. It was thus evident that a free communication existed between the joint and the cyst in the calf. The fluid discharged consisted of pus mixed with synovia. Subsequently the material flowing from the opening resembled synovia. The wound slowly healed, and the patient left the hospital a month later, with the knee somewhat flexed and stiff. On examining him at the end of a month from that date, Baker found the joint in a condition of osteo-arthritis (as he then believed the disease to be). There was some swelling; flexion and extension could be performed through a considerable range; there was grating on movement; and the ligaments were weakened or in part destroyed, so that the tibia admitted of free rotation. The joint was so weak that the patient could not walk on it.

In his second paper, Baker recorded the formation of similar cysts in the neighbourhood of the shoulder, elbow, and hip. A man, aged 24, had a swelling about

as large as a hen's egg in the middle of the arm in front of the biceps. This, which had the appearance of a cyst or of a chronic abscess, was punctured. About two ounces of fluid, straw-coloured and mixed with curdy lymph, escaped. For three or four days a good deal of clear fluid drained from the puncture. On the fifth day the patient complained of pain in the arm, his temperature rose to 104° , and pus flowed from the wound. Next day he complained for the first time of pain in the shoulder. Baker now suspected the real nature of the case. On questioning the patient, it transpired that he had felt pain and stiffness about the shoulder-joint for many weeks before his admission. About two months later the patient died of cerebral disease. No detailed description of the dissection of the limb was recorded, but there was no doubt at the time that the synovial fluid had made its way from the shoulder-joint to the middle of the arm by tracking in the course of the long tendon of the biceps muscle.

Fig. 32 illustrates the way in which the synovial membrane may be protruded through the posterior ligament of the knee and extend down the calf between the muscles, having only a narrow passage of communication with the joint-cavity. The following are the notes of the case:—

Mary B., aged 38, was admitted in July, 1873, with a large swelling in the calf of the right leg. The limb was slightly cedematous, the superficial veins were dilated and tortuous, and the leg from the ankle to the knee was twice as large as its fellow. The swelling was nearly uniform, but was especially marked in the calf, where deep-seated fluctuation could be detected. There was some effusion into the knee-joint. The patient complained of very little pain or tenderness in the limb. She said that the swelling had commenced after a slight injury five months previously, and had

continued slowly to increase. Two or three days after her admission the swelling in the calf was punctured with a fine tubular needle, and several ounces of a translucent, pale-red, viscid, alkaline fluid, containing



Fig. 32.—Cyst in the popliteal space, extending beneath the popliteus muscle into the calf, in a case of tuberculous disease. The condyles of the femur are eroded.

(From a specimen, No. 1,205v, in St. Bartholomew's Hosp. Mus.)

chlorides and a large amount of albumin, were drawn off; but neither pus nor blood. Considerable thickening of the upper part of the calf remained. The swelling quickly re-formed beneath the gastrocnemius, but then gradually diminished again, so that in Sep-

tember it was noted that there was "still some thickening in the upper part of the calf." Towards the end of September she was discharged, but it was observed that the knee had become much swollen, and the leg had assumed a position of abduction and eversion. In August, 1874, the patient was admitted under Baker's care. The swelling of the knee had to a great extent subsided; but after a fall, two months before her admission, the leg had been "out of place," and had become loose, and quite useless. There was little pain. The tibia was now dislocated outwards and backwards, and the leg was loose and flail-like, so that it could be replaced in fair position, though deformity returned as soon as restraint was removed. The synovial membrane was very much thickened; the bones grated as if the cartilage were lost; there was no tenderness or pain even on free movement. The whole extremity was wasted. No trace of the former swelling of the calf could be detected. In January, 1875, the limb was amputated. On dissection the joint-surfaces were found denuded of cartilage. A cyst containing four ounces of curdy pus was found beneath the popliteus muscle. Portions of the cartilage that remained were soft and pulpy. The ligaments had been almost entirely destroyed. The synovial membrane was thickened. The joint contained a considerable amount of viscid fluid.

In tuberculous disease of the elbow a cyst may form in connection with the joint and extend for some distance down the forearm, so that in some cases it seems at first sight impossible that it can be connected with the joint-cavity. A man, aged 40, was in St. Bartholomew's Hospital, in 1885, with a fluctuating swelling on the inner side of the elbow, about an inch above the internal condyle. This swelling, which was somewhat larger than a pigeon's egg, was fixed to the deeper structures. The elbow could not be extended

beyond an angle of 120° , nor fully flexed. The swelling had been first noticed about six months previously, and had so rapidly increased that the patient at once applied as an out-patient. The limb was placed on a splint. By continued rest the joint so far improved that the patient returned to work; but a week before his second admission he again noticed pain and swelling, and the arm could not be extended. A few days after he came in, the tumour was punctured and about three drachms of thin, glairy, and curdy fluid escaped. At the time the swelling almost disappeared; but as, a few days later, it had reaccumulated, another opening into it was made, when some yellow glairy fluid escaped. The patient shortly afterwards left the hospital, wearing a plaster-of-Paris bandage. In July, 1886, he returned. The elbow-joint was now found to be extensively diseased, and Sir W. Savory performed excision. At the operation the synovial membrane was found to be the seat of tuberculous disease. The ligaments were softened and the cartilage destroyed by ulceration.

Cysts in connection with the wrist- and ankle-joints.—I had under my care, in St. Bartholomew's Hospital, a woman, aged 34, both of whose wrist-joints were stiff and distorted. In both forearms ganglionic swellings of considerable size, and apparently multilocular, extended for some distance on both the palmar and dorsal aspects of the limb, the important point in each being that the ganglionic swellings communicated with the wrist-joint, a connection not present in the instance of the common ganglia associated with the sheaths of the tendons in this situation. The late Mr. Walsham had under his care in the hospital a child, aged 7, with an affection of the right foot. Seated over the instep were three fluctuating tumours of the size of walnuts, presenting the characters of bursal swellings,

but not apparently communicating with each other. On puncturing one of them, Mr. Walsham let out the usual glairy fluid contained in ganglia. On introducing a probe, the instrument plainly entered the ankle-joint.

The main clinical point in this group of cases—and it is a highly important one—is that swellings presenting the characters of cysts may have an occult and entirely unsuspected connection with one of the large joints, with the result that their puncture may, unless strict means to prevent sepsis are taken, be followed by suppuration in the articulations with which they are associated. Several examples of this occurrence have been recorded, and in some of them amputation has been required. The manner in which these synovial cysts are formed is well illustrated by the case recorded by Baker (*see* p. 246), in which, as the result of disease of the shoulder-joint, synovial fluid had tracked its way along the tendon of the biceps to the middle of the arm. The fact to be most carefully borne in mind is that there is often nothing to indicate, or even suggest, the connection of the cyst with the joint, nor any *prima facie* evidence of joint-disease. The cyst may be at a considerable distance from the articulation; there may be no intervening swelling; there may be no effusion into the joint; there may be, and commonly is, no fluctuation to be obtained between the joint and the cyst, and fluid cannot be pressed from the cyst into the joint. In fact, it is here, as in so many other instances, impossible to avoid falling into a serious error, unless the surgeon is forewarned by having become familiar with these cases, either by personal experience or by having had the advantage of reading such clear and full accounts as those which are contained in Baker's papers.

In two communications to the Pathological Society* D'Arcy Power has given the results of the dissection

* *Trans.*, xxxvi. 337, and xxxviii. 381.

of several of these "intermuscular synovial cysts," and has discussed the manner in which they originate. In some instances fluid, the result of effusion into the joint, escapes either into some bursa (often, in the case of the knee, into that under the semimembranosus) which communicates with the articulation, or through a hernial protrusion of the synovial membrane (Fig. 32). In some cases, however, enlargement of the bursa, Mr. Power remarks, seems to precede the joint-disease, and to be its predisposing cause.

The *treatment* of cystic swellings of this character must have reference, not only to the tumour itself, but also to the joint-disease with which it is associated. Fluid may be safely evacuated if the same care is taken as in the removal of a loose cartilage to prevent the introduction of septic agents, and if the limb is maintained at rest upon a splint. The puncture should be made with a small sterilised trocar and cannula on the first occasion; but if the fluid is thick and curdy, or if "melon-seed-like bodies" are present, a free incision and drainage may be required. The treatment of the affected joint must depend upon the nature of the case, and can be determined only when a careful diagnosis has been arrived at. It is important to notice that the prognosis as to the joint itself is, as a rule, unfavourable. Those most often affected have reached or passed middle life, when repair from tuberculous joint-disease is little likely to take place. (See p. 66, Senile Tubercle.)

CHAPTER XVIII

LOOSE BODIES IN JOINTS

Loose bodies found in joints may be of the following kinds:—

1. Masses of fibrin condensed and roughly pressed into shape. These are either mere hardened portions of blood-clot, or fibrinous concretions derived from inflammatory exudation, and resembling both in their general appearance and in their granular, or dimly fibrillated, microscopic structure, the “melon-seed-like bodies” met with in bursæ.

2. Blood effused into a synovial fringe may coagulate and form a pedunculated body, which, when its stalk gives way, falls loose into the joint-cavity. A football-player violently sprained his knee. The accident was followed by synovitis, and when this subsided the symptoms of a loose body in the joint were observed. During the operation for its removal it was found to be attached by a narrow pedicle, and to consist of recently effused blood-clot, covered with a layer of synovial membrane.



Fig. 33. — Enlarged and indurated fringe of synovial membrane, attached by a pedicle.

(From a specimen, No. 713, in St. Bartholomew's Hosp. Mus.)

3. A synovial fringe, or a portion of synovial tissue, may become (whether from injury or some other cause) enlarged and indurated, and is then apt to be caught and drawn out, by the movements of the joint, into a pedunculated body (Fig. 33). This may remain attached,

or its stalk may give way, and it may fall free into the articular cavity. Bodies of this origin consist of connective tissue and fat, often mingled with inflammatory products, and covered with synovial membrane. In some cases all the symptoms of a loose body are produced by the presence of a small but indurated toughened synovial fringe, which, having lost its power of free gliding, is liable to be caught and pinched between the bones. I have removed such a fringe from the elbow-



Fig. 34. — Osteo-arthritis of the shoulder-joint, in which the synovial membrane is studded with tufts, many of which contain nodules of cartilage.

(From a specimen, No. 666, in St. Bartholomew's Hosp. Mus.)

joint of a man of 30, and Sir Thomas Smith has removed one of like character from the knee-joint of a young woman. (See *Internal Derangement*, p. 266.)

4. The fine villous processes of the synovial membrane normally contain, as Rainey and Kölliker pointed out long ago, a few cartilage-cells embedded in their structure. In the course of subacute synovitis of long standing, due either to rheumatism or osteo-arthritis or provoked by injury, these processes enlarge, and many of them are converted into nodules of cartilage (Fig. 34). These, becoming pedunculated, may be accidentally detached (Fig. 35).

5. Pieces of articular cartilage, with or without a portion of the underlying bone, may, after injury, as pointed out by Teale, Sir James Paget, and others, exfoliate and drop loose into the joint without the symptoms of inflammation usually observed in cases that end in necrosis (Figs. 36 and 37). Such cases are good illustrations of what Paget described as "quiet necrosis."

6. Or a piece of cartilage, or of cartilage and some of the adjacent bone, may be chipped off and fall into the joint. In the museum of St. Thomas's Hospital, specimen D 110 is thus described* by Sir J. Simon:—"Broken-off bit of condyle loose in the knee-joint.—A young man who, in falling, had wrenched his knee, came into St. Thomas's Hospital to be treated for some inconsiderable synovitis which followed the accident, and while under treat-



Fig. 35. — Nodules of fibro-cartilage, attached by an elongated pedicle.

(From a preparation, No. 712, in St. Bartholomew's Hosp. Mus.)



Fig. 36. — Portion of the articular cartilage of the femur, which exfoliated and was removed by operation from the knee-joint.

(From a preparation, No. 721, in St. Bartholomew's Hosp. Mus.)

ment was found to have a loose body in the joint.

* *Path. Soc. Trans.*, 1864, xv. 206.

As soon as all of the acute symptoms had subsided (about three weeks after the accident) I operated for this loose body, and, having removed it, found that it was a broken-off bit of the articular end of the femur covered on one side with its natural cartilage, and



Fig. 37.—Portion of the articular surface of one of the condyles of the femur. It consists of articular cartilage and a layer of subjacent bone. Removed from the knee-joint.

(From a preparation, No. 722 A, in St. Bartholomew's Hosp. Mus.)

about the size of a bean." I am indebted to Mr. Shattock for the following report of this loose body:—

"The cartilage in Sir J. Simon's specimen has every character of healthy articular cartilage, in arrangement of cell-groups and homogeneity of the matrix. There can be no doubt whatever that the loose body is a portion detached from an articular surface."

Mr. Bruce Clarke has recorded* the following example: A man, aged 28, slipped as he was mounting an omnibus and struck his knee-cap against the edge of the step. While

he was in the hospital on account of a sharp attack of synovitis, it was found that the internal semilunar cartilage moved freely in every direction. An operation was therefore undertaken for its treatment. It was then discovered that a piece of cartilage from the under-surface of the patella had been knocked off, evidently quite recently, so that the subjacent bone was exposed. At this moment the missing piece of cartilage was floated up into view and picked out. It was carefully compared with the abraded surface. Into this surface it exactly fitted. Mr. Clarke remarks: "It would appear, if the history of the accident is correct, that the patella was knocked by the step of the omnibus and partially dislocated, so that the cartilage

* *Path. Soc. Trans.*, xlii. 273.

on its under-surface was abraded by the edge of the condyle of the femur."

In another case, under the care of Mr. Gordon Watson, there were symptoms of a loose internal semilunar cartilage, but at the operation it was found that a portion of the articular cartilage (one inch by three-quarters of an inch) at the margin of the inferior surface of the internal condyle had been fractured and remained loosely attached to the femur, so that, on movement of the joint, it rocked to and fro. The free margin of the cartilage showed signs of chronic inflammation from friction, but there were no other signs of injury or disease.



Fig. 33. — Masses of new bone (osteophytes) detached from the articular margin of the hip-joint in a case of osteoarthritis. The joint, when opened in the dissecting room by Abernethy, contained fourteen loose bodies of this kind.

(From a specimen, No. 723, in St. Bartholomew's Hosp. Mus.)

7. *Osteophytic* growths around the articular borders in osteoarthritis may break off into the joint-cavity (Fig. 38).

8. Mr. Shaw * has published a case in which a loose body was found, on removal, to contain the point of a broken needle. Probably the needle, accidentally embedded in the subsynovial tissue, had, by causing irritation, led to the formation of the body, which had subsequently become detached.

9. *Tuberculous loose bodies.*—In excising a knee for tuberculous disease, in a girl aged 17, I found five loose bodies in the joint. They were about the size of almonds, glistening, and perfectly smooth on the surface, of a pale-yellow colour, and consisted apparently of fat.

* *Trans. Path. Soc.*, vi. 328.

On examining the section of the femur which had been removed during the operation, I found two similar bodies still attached to the synovial membrane. These bodies were all found, after being hardened in alcohol, to consist of a shell or capsule, enclosing a central mass with an intervening space. The capsule was firm, and of the consistence of coagulated fibrin (Fig. 39). The central portion resembled those ragged masses of

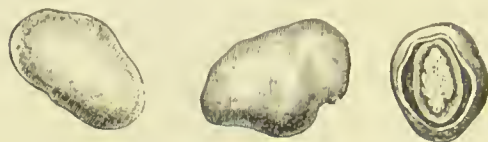


Fig. 39.—Tuberculous loose bodies from a knee-joint.

(From a specimen, No. 712D, in St. Bartholomew's Hosp. Mus.)

fibrin which are often found in bursæ. I am indebted to Dr. Edgar Willett, formerly the Curator of the St. Bartholomew's Hos-

pital Museum, for the following report: The outer layer (or capsule) is composed of a uniform collection of granular cells, without stroma or definite structure. The kernel has an imperfect and irregular structure, the most striking feature of which is the presence of a considerable number of well-defined cells, either circular or irregular, and recalling at once the look of giant cells found in tuberculous deposits. Although no tubercle bacilli were found, Dr. Willett regarded those bodies as certainly tuberculous. The case is described in the *Path. Soc. Trans.*, xlii. 276.

In an able and interesting essay on tuberculosis of the bones and joints, Mr. Alexis Thomson remarks that in cases of nodular tubercle of the synovial membrane (as described by Riedel) pedunculated excrescences and nodular masses, often of considerable size, may project from the surface of the membrane. These, rendered pendulous by the movements of the joint, may at length be detached, and constitute loose bodies similar to those above described.

The number of loose bodies in joints is subject to great variety, and depends on their mode of origin. They are frequently single; but when they are formed in joints affected with osteo-arthritis there may be as many as from six to twenty or more. Abernethy found fourteen in the hip-joint of an old woman in the dissecting-room (Fig. 38).

On one occasion Sir T. Smith removed 415 bodies from a knee-joint; all were about the size of large peas, and composed of hyaline cartilage; only five or six were attached; the remainder were entirely free in the synovial cavity (Fig. 40).

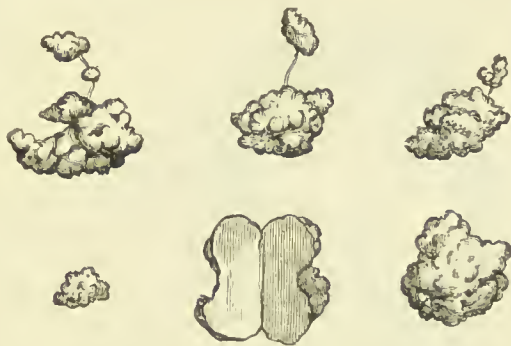


Fig. 40.—Specimens of the loose bodies found in the knee-joint in Sir T. Smith's case.

(From St. Bartholomew's Hosp. Mus.)

Mr. Berry has recorded* the case of a woman, aged 22, from whose knee-joint he removed no fewer than 1,047 loose cartilages exactly resembling those described by Sir Thomas Smith.

About twenty years ago I removed thirty loose bodies from the cavity of the knee-joint and five from the semimembranosus bursa of a gentleman, 23 years of age. The great majority were quite detached, but several were still connected with the synovial fringes by slender pedicles. Numerous cartilaginous nodules, too small for removal, were left. It is interesting to note that no recurrence took place.

10. Subsynovial lipomata may become pedunculated and project into a joint-cavity.

* *Path. Soc. Trans.*, xlii. 275, and xlv. 138.

Fig. 41 shows a patella to the inner side of which a pedunculated lipoma is attached. The history of the case is unknown.

Symptoms.—It will be clear from what has been said above, that under the name of loose bodies in joints several forms are included which differ from each other alike as to their origin, the condition of the joint in which they occur, and the degree in which they are



Fig. 41.—Pendulous lipoma attached to the inner side of patella.

(From a specimen, No. 716, in St. Bartholomew's Hosp. Mus.)

movable in the articular cavity. It would, therefore, be expected that the different kinds must present considerable differences in the symptoms to which they give rise. As this is actually the case, it will be best, in the first place, to describe a simple and characteristic example and then to allude to instances in which the diagnosis may be attended with difficulty.

In a case in which a loose body containing cartilage and derived from a hypertrophied fringe has become detached, and is free in the cavity of an otherwise healthy knee-joint, or in which a piece of the articular cartilage has been shed (Fig. 36), the first evidence of its presence generally is that the patient, while in the act of walking, is seized with such intense pain in the joint—coming on as suddenly as if it were due to a blow—that, losing all power in the limb, he falls to the ground, overcome with a

momentary sensation of faintness. Sometimes the joint remains freely movable, and the patient is able to walk when, after a few minutes, the pain has somewhat abated. In other and rarer instances he finds that the joint is fixed in a position of more or less flexion, often combined with rotation of the tibia outwards, while any attempt to move it is attended with great suffering. This fixed condition may remain for some hours, and then on some slight movement suddenly disappear; or it may continue till the limb is subjected to surgical manipulation. The accident is followed by a sharp attack of synovitis, lasting three or four days. On examining his joint when the acute attack has gone off, the patient perhaps detects the loose body, and learns that it shifts its position, so that he finds it now in one situation, now in another, while at other times he is unable to discover its locality. On account of the manner in which these bodies change their site, and slip out of reach, the Germans have suggestively called them "joint-mice" (*Gelenk-Mäuse*). The frequency with which the symptoms recur varies in different cases. In some instances the patient feels no inconvenience for three or four weeks, or for several months at a time. Especially is this the case when the loose body is of such a size or shape that it is only in certain movements of the joint that it can be caught. In others, however, the attacks are of more frequent, and even of daily, occurrence. The symptoms are usually more severe at first than at a later period, when the joint appears to become more tolerant; but, in some cases, the frequent repetition of the injury leads to chronic effusion into the synovial cavity.

In cases of osteo-arthritis in which osteophytes become detached (page 257), as the movements of the joint are usually considerably interfered with by other changes, the symptoms are less typical. The patient,

however, experiences a sharp and often excessively painful catch or sudden locking of the joint (which becomes fixed against movement in certain directions), and a body that changes its place may be discovered. When several are present, movement of the joint is very painful and restricted, and attended with a peculiar cracking or grating sensation. The patient also complains of a feeling of insecurity in the joint, which often gives way, so that he is in danger of falling.

In some instances, though the symptoms of a loose body are well marked, the patient may never have discovered the presence of the body, nor can it be detected on careful and repeated examination, and it may be necessary to open and explore the joint. This was the course taken in the following case: A lady, aged 21, had for three years had all the usual symptoms, in a very severe form, of a loose body in her knee, but none had ever been recognised. Mr. Walsham exposed the cavity of the joint by sawing through the patella transversely. An abrasion of the cartilage on the posterior aspect of the internal condyle of the femur was seen, and on fully flexing the limb a loose cartilage, three-quarters of an inch by half an inch, and a quarter of an inch thick, slipped out of a pouch behind the posterior crucial ligament, where it had apparently been permanently lodged. Probably in some instances in which the symptoms are ascribed to slipping of one of the semilunar cartilages (p. 279 *et seq.*), they are really due to a loose body in some part of the joint in which it cannot be detected. Thus, in a specimen in the museum of the College of Surgeons, one is attached by a pedicle to the anterior crucial ligament in a position in which it could not be felt on external examination, but in which it might easily have impeded the action of the joint by becoming nipped between the ligament and the neighbouring

condyle of the femur. A gentleman complained that his knee often "caught" and gave him sharp pain; and he could not completely extend it. After a violent wrench of the limb these symptoms entirely disappeared, and a loose body, which, however, caused him no inconvenience, was found slipping freely about in different parts of the joint. No doubt the "catch" experienced was produced by this body, which had been at first attached, but was separated by the wrench. The symptoms are usually obscure when the body is merely an indurated synovial fringe. Whenever this is pinched there come pain, limitation of movement, and subsequently some synovitis, yet no direct evidence as to the origin of these symptoms will be apparent. But such a condition may be suspected if, between the attacks, the joint is found to be normal in appearance, and will sometimes move freely, while at others, during some trivial movement, it suddenly "catches." The patient often knows which movements produce the symptoms, and also how, when it has become fixed, he can disengage the joint.

Treatment.—There are doubtless a certain number of cases in which no operative interference is advisable; e.g. those in which either the loose body causes but slight inconvenience, or is easily kept from passing between the ends of the bones by the application of a knee-cap. The form of apparatus for accomplishing this varies with the case; but that which is most often useful consists of a laced knee-cap with a pad arranged to take effect at some point at which experience has taught the patient, or the surgeon, that pressure will fix the loose body. In other cases, especially of arthritis deformans, the joint may have become so irremediably stiff and crippled that little would be gained by removing any loose body that was detected.

In the great majority of instances, however, operative

interference is called for, and may be safely adopted. Moreover, most of the cases of loose cartilage occur in persons between the ages of 20 and 50, whose joints are otherwise healthy, or at least not extensively diseased, and in whom, if performed with care, an operation entails very slight risk.

It may not, however, be out of place to state that while a joint may be opened and treated with all necessary freedom, provided complete asepsis is secured, instances are not rare in which, owing to some flaw in the system adopted, infection, followed by disaster, occurs. The natural reaction of the tissues to infection is what it was in the days of Cooper and Brodie. I remember to have seen, in consultation, three cases in which, after operation for the removal of a loose cartilage, the knee-joint had suppurated.

The operation is thus performed: The loose body must be found, and fixed in the spot at which it is proposed to remove it. It may save disappointment if the trick of fixing the body has been practised beforehand by the assistant to whom this office is to be entrusted. When the patient is insensible, one or two strong sterilised needles in handles should be used to transfix and steady the cartilage. This should now be exposed by a careful dissection, and removed, any bleeding having been stopped before the joint is opened. Should the cartilage accidentally slip away during the operation, it must, when the joint has been freely opened, be either searched for with the finger, or be washed out by a strong current of hot saline solution, introduced by means of a syringe or an irrigator. The wound in the capsule should then be accurately closed with a continuous suture of fine catgut. The external parts should be brought together by sutures passed down to, but not including, the synovial membrane. I have used a splint for about a week. Some surgeons, how-

ever, merely support the limb on pillows so that it is in a comfortable position. No drainage should be used.

It is well to remember that though the patient is only cognisant of one loose body, there may be others tucked away in the joint which do not come to the surface. An officer on the staff in the South African War was invalided because of a loose body in the knee, which interfered with his riding. It used constantly to appear at the inner side of the patella, and by flexing the knee he was frequently able to keep it there. Attempts were made to secure it and remove it under eucaïne, but on two successive occasions it escaped at the critical moment. The joint was eventually opened under general anæsthesia, and five loose bodies were removed. The patient had never been conscious of more than one, which had always appeared in the same place.

CHAPTER XIX

INTERNAL DERANGEMENT OF THE KNEE AND OTHER JOINTS

IN a paper which has become classical, Hey,* as long ago as the year 1803, described five examples, selected from many he had observed, of what he called internal derangement of the knee-joint. The name was a good one; for, without involving any theory as to the manner in which the condition was produced, it served as a clear heading for the group of cases he had to relate. From a clinical point of view, also, the phrase was appropriate. It exactly conveys what can be seen, and what the patients themselves describe, in many of these cases, namely, that something has occurred in the joint which has reduced it to a condition that may be compared to that of a hampered lock, or, as some have said, to a gate with a stone in its hinge. Such a joint will move freely in one direction; but in the other, when it has reached a certain point, its motion is suddenly arrested. Very generally the joint is locked in a position of slight flexion and eversion of the leg, so that the limb cannot be completely straightened. The patient can usually walk on the limb, but he does so with an obvious limp.

The idea of internal derangement also well accords with the suddenness with which, on some trivial movement, or slight twist of the limb, the accident may be produced, and equally well with the manner in which,

* "Practical Observations in Surgery," by W. Hey, p. 327. 1803.

during some trick of handling the joint, or in some casual or unconscious movement, something is felt to slip, or a snap is heard, and the impediment is found to have suddenly disappeared. One patient told me his knee was very apt to slip if, forgetting himself for the moment, he crossed his leg over the other while he was sitting; another, that his knee would always slip if he sat on his heels with his limbs adducted; a third, that his knee "went out" if, when the limb was nearly extended, his toe was suddenly turned outwards: and all these patients knew exactly by what equally slight counter-movement the lock could be removed.

Some of Hey's cases are so characteristic that they may well be quoted. His first case occurred in 1782:—

Case 1.—A gentleman, while turning himself in bed, felt a sudden pain at the insertion of the biceps into the head of the fibula, and that tendon seemed rather on the stretch. In other respects the joint appeared perfectly natural. When Hey examined the knee he could bend and extend the limb as freely as the sound one. There was no swelling in any part of it. There was no protrusion of the semilunar cartilage. The patient had twice before had similar lameness, which on both occasions had left him instantaneously. After walking a few steps, and while he was talking to Hey, the patient suddenly cried out, "I am quite well!" and immediately was able to walk without the least degree of lameness.

Case 2.—In 1784 a young lady, while standing on one leg, and stretching forwards to lift a child, strained her knee, as she supposed, and immediately became lame. Five or six days later, Hey, on comparing the two knees, could find no difference, except that when the limbs were placed in a state of complete extension the ligament of the patella of the injured joint seemed rather more relaxed than the corresponding ligament of the opposite side. Passive movement caused no pain; but the patient in walking could neither fully bend nor fully extend the knee; she walked with the limb bent, and with pain and a considerable limp. Placing the patient on a high seat which had nothing underneath it to prevent the leg from being fully flexed, Hey, after he had extended the limb, suddenly moved

it into full flexion. After repeating this movement (extension followed by complete flexion) he found the patient could immediately walk without lameness. Three days later she danced without inconvenience or receiving any injury from the exercise.

Case 3.—Two years subsequently the young lady produced the same injury in rising hastily out of bed. After the lameness had continued about a week, Hey was again consulted. His method of treatment described above was made use of, with the same immediate success.

Such is Hey's account, and subsequent observation has confirmed the general accuracy of his description.

In the following paragraphs I shall first relate, and remark upon, a selection from the examples which have come under my own observation, or which I have found recorded—including varieties of the accident not known to Hey—and then the general question of treatment will be discussed.

Simple displacement :

Case 1.—Mr. Todd White relates * the case of a man, aged 33, who, after kneeling for some time on the floor in a posture "as if sitting on his heels," was seized, while in the act of rising, with sudden and severe pain in his right knee, and found that he was unable to straighten his limb. Three days afterwards Mr. White saw him. The knee could be considerably bent, and there was no swelling ; but any attempt to straighten it caused great pain. There was great tenderness over the inner tuberosity of the tibia ; none over the outer. When the patient was under an anæsthetic the limb was bent and then forcibly extended, at first without result ; but when this movement was repeated (the thumb being firmly pressed over the tender point) a slip was felt, and the limb was found to be again freely movable.

Case 2.—W. R., aged 33, slipped off a plank a few inches from the ground and wrenched his knee. He

* *Lancet*, 1856, i. 11.

immediately found that the joint was locked in a partially flexed position and that any attempt to straighten it gave him severe pain. The displacement was corrected by flexion and rotation of the tibia inwards and outwards on the femur, followed by extension. Two years later, when he was superintending the building of a house, and as he was stepping across some rafters, his foot slipped, and the knee again became locked in a bent position. I saw him two days later. The knee was flexed at an angle of about 110° , and any attempt to walk upon the limb produced severe pain. He had no power of moving the joint. When he had taken ether I completely flexed the limb, and rotated the tibia on the femur; but, on attempting to straighten the limb, I found the joint was still locked against full extension. On repeating, however, the movements of full flexion and rotation, followed by extension, a sharp snap was heard, and the limb was then found to be freely movable. On recovering from the ether the patient could move the limb in a perfectly natural manner. A year later there had been no return of the displacement.

Case 3.—I have notes of a case in which a young lady at a dancing lesson was reprimanded for not turning her toes out sufficiently, and was made to stand at the end of the room with her heels together and her feet strongly everted. Ordered by the master to turn the toes out still farther, in making the effort to do so she felt something give way, and suddenly fell to the ground, having dislocated her internal semilunar cartilage.

Laceration of the normal attachments, followed by displacement:

Case 4.—There is in the museum of St. Bartholomew's Hospital a cast (Fig. 42) representing displacement of the internal semilunar cartilage. Over the situation of the cartilage there is a deep depression.

The man had been knocked down, and had fallen with his knee bent under him, and from that instant was unable to bear any weight on the limb. During an examination, while the knee was bent to its utmost, a sudden snap was heard; the depression on the inner side of the joint disappeared, and free mobility was restored.



Fig. 42. — Displacement of the internal semilunar cartilage of the knee-joint, with the formation of a deep sulcus in the skin (indicated by dark shading).

Case 5. — Sir William Fergusson* found, in a subject brought to King's College for dissection, that "one of the semilunar cartilages had been torn from the tibia throughout its whole length with the exception of its extremities, so that during flexion and extension it occasionally slipped behind the articular surfaces. The cartilage was flattened on its outer margin, and when it passed behind the condyle of the femur seemed to fit to the articular surfaces as accurately as the internal cartilage does in the natural condition of the parts."

Fergusson does not state which cartilage was thus displaced, nor is there anything in his description to settle this point.

Case 6. — Dr. Reid † exhibited a specimen, taken

* "Practical Surgery," p. 360, 4th ed., 1857.

† *Edin. Med. and Surg. Journ.*, 1834, xlii. 377.

from the body of a patient who died in the Edinburgh Infirmary. The history could not be traced. While in the infirmary the man had made no complaint of his knee, nor did the nurse remember to have observed any limp in his walk. The fibrous tissue connecting the outer margin of the external semilunar cartilage with the edge of the tibia was torn through in its anterior half, and the semilunar cartilage was found thrown inwards and backwards, and placed between the spine of the tibia, the posterior crucial ligament, and the posterior ligament of the joint. The cartilage itself was considerably flattened and broadened, and the remaining portion of the fibrous tissue connecting its outer margin with the tibia was much thickened, and had assumed somewhat of a fibro-cartilaginous appearance. The motions of the articulation seemed free, as far as could be judged in the dead body.

Case 7.—Mr. Godlec exhibited a specimen at the Pathological Society,* found by Professor Thane in an old anatomical preparation at University College, in which the external semilunar cartilage was displaced. The cartilage had been torn away, at its circumference, from its attachment to the capsule of the joint, and had become displaced inwards, so that it lay in the notch between the two condyles of the femur. The displacement, Mr. Godlec remarked, must have occurred some time before death, for the cartilage remained stiffly in its abnormal situation, and appeared to have somewhat shrunk from its natural size; it was also obviously flattened by the pressure of the inner part of the condyle. A drawing accompanied Mr. Godlec's description of this specimen.

Case 8.—A labourer, aged 21, was under Mr. Lucas at Guy's Hospital in 1879. He stated that two years before, in an attempt to get out of a hole in the

* *Path. Soc. Trans.*, xxxi. 240.

ground, he had thrown the whole of his weight on the inner side of his right leg and foot, and had thus injured his knee. He was weak in the joint for some weeks afterwards, but felt no permanent ill effects. Three weeks before applying at the hospital he twisted his knee in descending a ladder. The joint, he said, became suddenly locked, so that he lost power in the limb. He complained of little pain; but on flexing and extending the joint a curious phenomenon occurred. When the knee was about half flexed, the leg and foot moved inwards with a sudden jerk, and at the same time a projection occurred on the outer side of the patella which could be seen and felt. On extension, the leg and foot jerked suddenly outwards, and the semilunar cartilage went back into its place. The joint was enclosed for four months in plaster-of-Paris, and was subsequently treated by passive movement. At the end of six months after he was first seen, the patient was discharged, the movements of the joint being free and smooth, and there being no longer any tendency to displacement. Mr. Lucas believed that "when during flexion the leg and foot received a sudden twist, and a shock was communicated to the hand, the convex part of the external condyle of the femur had slipped behind the posterior rim of the semilunar cartilage; and that when, during extension, the leg became straight with a similar, though less evident jerk, the condyle had slipped back over the cartilage, and the parts had resumed their normal position." *

Laceration of one of the semilunar cartilages:

Case 9.—A clergyman, aged 25, kicked at a football with his right leg, and, missing it, swung round on his left limb and fell to the ground. On rising he found he could not walk. Six weeks later, and when the swelling of the left knee which followed the accident

* *Brit. Med. Journ.*, 1879, ii. 774.

had subsided, he was still unable to walk except with two sticks. On examination, the joint presented a loose body on its inner side, immediately in front of the internal lateral ligament. During the operation for its removal the body was found to be held *in situ* by a small band of ligament. It proved to be three-quarters of an inch in length, and to consist of the anterior portion of the internal semilunar cartilage, retaining in every respect its normal appearance.

Case 10.—In a subject lately in the dissecting-room of St. Bartholomew's Hospital a considerable piece had become partially detached from the rim of the internal semilunar cartilage, and was found standing up like a tongue, so that it would have the effect, when it was nipped between the bones (as it was in certain positions of the joint), of locking the knee. A deep groove on the cartilaginous edge of the femur had been formed, by long pressure, for its accommodation.

Case 11.—In an artillery officer, aged 25, there was a small swelling just beneath the skin over the inner side of the knee, which I thought was a projection of synovial membrane through a hole in the capsule. At the operation for its removal it proved to be one end of the internal semilunar cartilage, which had been torn completely across about its middle.

One of the cartilages may not only be loose, but may slowly undergo inflammatory enlargement, so that it becomes a source of mechanical difficulty.

Case 12.—Emma T—— is now 27. When she was 14 she fell down some steps, and severely bruised her right knee. After lying on the sofa, however, for two or three days she lost all pain, swelling disappeared, and she thought no more of the accident. Two years later, when, as an apprentice to a draper, she had to stand many hours in the day, she found

that the knee became painful and swollen. For this condition she was recommended to rest the joint. Two years later, the joint, which in the interval had continued weak, painful, and often swollen, began to slip and lock. At first the slip was only to a slight extent, and the knee righted itself spontaneously, and at the moment. But the lock soon became more complete, and she grew into the habit of asking her friends to help her to correct it, and "get the joint in." This she found could always be done by "raising the heel and shaking the knee." When she presented herself in the out-patient room at St. Bartholomew's Hospital the joint was found to be freely movable and quite cool, and nothing abnormal could be observed except on the outer side in the interval between the femur and the head of the tibia. Here, situated in a horizontal position, between the two bones, was a swelling about three-quarters of an inch in length from before backwards, and about half an inch from above downwards, which seemed clearly to depend on enlargement of the external semilunar cartilage and thickening of the synovial membrane. When the knee was fully extended this swelling protruded nearly to the size of a ring-finger; when the knee was flexed it receded, leaving the outline of the joint quite natural. The slip occurred at this period once or twice in every week.

I regarded the case as one in which the external semilunar cartilage had undergone gradual enlargement in consequence of injury, aggravated by overlong standing. The slipping was probably owing to the gradual increase in size of the cartilage, and the stretching of its attachments, which resulted from the manner in which the bones, as they moved one upon the other, forced it out from between their opposed surfaces; while the lock occurred whenever the cartilage, instead of gliding out, was caught between the bones.

The clamp described below (Fig. 43) was applied. From this time, though the joint occasionally gave way to a slight extent, it never slipped as it had previously done, and no manipulation was required to set it right. Two years later the patient was still wearing the clamp. The joint looked natural except at the outer part, where, as before, when the limb was extended, there was a swelling in the situation of the external semilunar cartilage about as large as a small walnut, embedded in thickened and indurated synovial membrane. On flexing the joint the swelling disappeared. The patient had a good deal of pain in the joint, and considerable swelling occurred when she was long on the limb, or after a long walk.*




Fig. 43.—Clamp for use in cases of displacement of a semilunar cartilage (Ernst). The degree of flexion allowed is controlled by a detachable screw.

This case appeared to be similar to one recorded by

* This account was written some twenty years ago. At the present day removal of the cartilage would, of course, be definitely recommended.

Malgaigne.* The patient was a female who had previously had severe inflammation of the joint, which ended in enlargement of the external semilunar cartilage. One day, on attempting to put the limb to the ground, she fell down, and Bassius, who was called in, found the cartilage greatly enlarged and projecting outwards. It was reduced by pressure, but required a plaster and bandage to retain it in its place.

A curious condition of the knee, apparently congenital, and depending on **very wide slipping of one of the semilunar cartilages in its relation to the corresponding femoral condyle**, is sometimes met with.

Case 13.—Many years ago, a girl, aged 9, was under my care, at the Hospital for Sick Children, for her kneecs. In the left knee exactly the same phenomenon as that described by Mr. Lucas (p. 272) was observed when the limb was flexed and extended; and the jerk of the leg was accompanied by a dull snap. The right knee occasionally jerked during flexion and extension in the same manner as the left. The condition had been noticed very soon after the child's birth. Both joints were very loose, and the head of the tibia could be moved from side to side on the condyles of the femur when the limb was flexed. I kept the left joint fixed on a splint in the extended position for four months, but without benefit. I then lost sight of the case.

I have seen two other apparently precisely similar cases—one in an infant only a few months old (shown to me by Sir Thomas Smith), in whom the condition seemed to be due to some congenital abnormality; and one in a boy of 12. In this instance a knee-clamp was applied, and a few weeks later the boy was admitted with an acute attack of synovitis, partly

* "Traité des Fractures et des Luxations," ii. 968. 1855.

due to his having drawn the strap above the patella too tightly, and having walked about with the knee thus constricted. When the synovitis had passed off, I found that the knee no longer jerked on movement. No doubt the cartilage had become (at least for the time) fixed in its normal position by adhesions.

Fracture of a semilunar cartilage in its circumference:

In rare instances, as the result of injury, the cartilage may be split in its circumference. In a case operated on by Mr. Gordon Watson the internal semilunar cartilage was firmly attached at each extremity, but in between the points of attachment was split longitudinally, so that the inner half could be displaced inwards and the outer half outwards.

Thus it will be seen that *internal derangement* must now be regarded as a general term, including many conditions which differ considerably from each other. These are chiefly: (1) Mere displacement of one of the semilunar cartilages in relation to the bones between which it lies, without laceration—but often dependent on some relaxation—of its attachments (Cases 1 to 4). This condition of relaxation may either be such as is naturally present in those who are “loose-jointed,” or it may result from chronic synovitis following injury, or from arthritis deformans. (2) Displacement of one of the semilunar cartilages, after more or less wide laceration of its attachments (Cases 5 to 8). This is the most common form, and is frequently met with in football-players and other athletes. (3) One of the semilunar cartilages may be extensively lacerated, or even torn completely across, so that it can be felt as a loose body (Cases 9, 10, and 11). (4) The cartilage may become enlarged, and interfere with the movements of the joint (Cases 12 and 13). (5) Some congenital malformation may apparently exist

(Cases 13, 14, and 15). In what this consists, however, I am unable to state, as I know of no dissected specimen. In some instances the symptoms of internal derangement depend on the presence of an indurated fringe of the synovial membrane, which is caught between the bones.

The joint that is by far the most liable to internal derangement is the knee. I have, however, seen it produced in the elbow by a toughened synovial fringe, and I have heard of the case of a lawyer, whose jaw, at some critical moment in the middle of a speech to the jury, would suddenly slip and become locked, so as to fix his mouth in a half-open and unsymmetrical position. Overtaken by this accident, casting an appealing glance at "my lud" and the gentlemen of the jury, and looking unutterable things at his learned friend opposite, who loaded him with amiable condolences, he would bury his face in the folds of a large handkerchief, with which he was always provided, and rush into the privacy of an adjoining room, whence—having, by a trick he had acquired, got his jaw in again—he would return and continue his address.

In the knee the internal cartilage is involved much more frequently than the external; but the latter is, beyond doubt, often concerned.

The late Mr. H. W. Allingham* gives an account of 59 cases in which he opened the knee-joint for symptoms of internal derangement (including loose bodies). An analysis of these shows the following: Operations on the internal semilunar cartilage, 34; on the external, 1; loose bodies, 12; ligamenta alaria, 2; synovial fringes or rheumatoid arthritic changes, 7; and 3 cases in which no changes were found.

Of the 35 cases in which the semilunar cartilages were involved, 11 were not detached but were loose

* *Lancet*, March 15, 1902.

with varying degrees of mobility, 8 were detached at the anterior extremity, 3 at the posterior extremity, 8 at their coronary attachment, but fixed at their extremities, 4 were split in varying extent in their circumference, and 1 was torn across transversely.

Mr. Robert Jones * gives an analysis of 117 cases operated on for lesions of the semilunar cartilage, as follows :—

53 torn from anterior attachment.

16 split longitudinally.

12 fractured transversely opposite internal lateral ligament.

8 loosely bound circumferentially.

8 attached by the cornua and torn from the capsule.

8 showed nodular changes in a loose anterior extremity.

7 were displacements of the posterior horns.

3 exhibited no trace of the cartilage.

2 showed the anterior part doubled and adherent to the posterior.

Age.—The accident is most common in persons between 20 and 50, but it may occur (in chronic inflammation of whatever form or in osteo-arthritis) in people above the latter age. It is important to remember that the accident is sometimes met with in children. A few years ago, a little girl, aged 9, was under my care at St. Bartholomew's Hospital for lameness of four months' duration, clearly resulting from displaced internal cartilage. The symptoms disappeared on manipulation. I have seen a case in a schoolboy of 13, and one in a girl of 8.

Diagnosis.—This condition of internal derangement of a joint is, in its slighter forms, apt to be overlooked. Yet its recognition is usually, when care is taken, not a matter of any real difficulty. The symptoms bear a general resemblance to those of a loose body, but they differ widely in the various groups of cases noticed above. The most clearly marked instances are those (Cases

* "Annals of Surgery," Dec., 1909.

1, 2, 3, 8, and 9) in which a person, on wrenching or twisting his knee, is attacked with sudden and severe pain, and finds his joint is "out," or locked, so that he is unable to straighten it. On examination, nothing to account for this condition can generally be either seen or felt; but sometimes either a depression (Case 4) or a protrusion is detected in the situation of one of the semilunar cartilages. The accident is usually followed by a sharp attack of synovitis, lasting from three to ten days, or even longer. When one of the cartilages is torn from its connections, or torn across, the symptoms noticed in Cases 10 and 11 will characterise the injury.

In the less marked examples in which the cartilage, owing to relaxation of its attachments, has a too free range of movement, or in which an enlarged and indurated synovial fringe is nipped between the bones (p. 253), the patient states that, although his knee between the attacks is perfectly free, he often finds that it suddenly locks or "catches"; that he feels pain, which is in some cases—though this is rare—so severe as to induce faintness, or to bring him to the ground, in others but slight; that the lock is only momentary or that it remains till the knee is manipulated; that the "slip" is followed by two or three days of pain, swelling, and heat of the joint. There is often tenderness or definite pain on pressure over the position of one or other, generally over the internal cartilage, for this is much more frequently concerned than the external. This symptom deserves particular attention. It may remain for a week or ten days after a "slip" has occurred. In these cases there is usually no visible displacement. In cases of arthritis deformans, diagnosis will turn on the patient's account of the sudden "lock," together with the symptoms mentioned under that heading.

The cases most apt to be overlooked are those in

which the injury that leads to displacement of one of the cartilages is severe enough to induce an acute synovitis; or in which the displacement itself leads to the latter complication. In such instances, unless the possibility of displacement is borne in mind, the case will be regarded as one merely of synovitis, and the stiffness remaining after the inflammatory attack has subsided will be attributed to this cause and not to the fact that the cartilage is still displaced. Oversights of this kind are to be regretted. They prolong the time—it may be for several months—during which a person, to whom it is of the first importance to regain the use of his limb (a labouring man, for instance), is allowed to remain crippled; and they drive the patient to a bone-setter, with the result that the movement employed, however rough it may be, is very likely to produce a cure, to the no small discredit of surgery. A gentleman some time since remarked that he wished surgeons would be more careful in the management of their cases. When I asked him to reduce this sweeping reflection to the particular instance he had in view, he said that his gamekeeper had been for a month in a hospital for lameness, and had been discharged no better, and that on leaving the hospital he had gone straight to a bone-setter, who told him his knee was out, and there and then “put it in.” When, my censor continued, the man expressed surprise that the doctors did not find that his knee was out, the bone-setter replied, “Oh, doctors understand the big bones, but they know nothing about the little ones”—a remark which seemed to the patient, and also, I found, to his master, a full explanation of what had occurred. From what I subsequently learnt, there seemed no doubt that the case had been one of internal derangement, followed by synovitis, in which the latter complication had led to the displacement being overlooked, this remaining to cause

lameness after the synovitis had subsided. There was a clear history that the joint had slipped on a previous occasion.

Treatment.—This consists of two parts: 1, the reduction of the displacement, when the “lock” persists; 2, the prevention of a repetition of the accident.

1. In many cases the displacement is only momentary, while in others the patient either knows how to effect reduction himself, or is able to instruct a passer-by how to do it for him. A gentleman told me that sometimes in his country walks his knee “went out,” and he had to sit by the roadside till someone came past, and, carrying out his directions, put the joint in for him.

The manipulation most often successful consists in bending the knee to the fullest extent on the thigh, drawing upon the tibia as if to separate the articular surfaces, rotating the tibia on the condyles of the femur inwards and outwards, and then extending the leg upon the thigh quickly, but not with any undue violence. At the same time, pressure with the thumb should be made on any part of either semilunar cartilage which is tender or seems abnormally prominent. Reduction may often be effected without the use of an anæsthetic. In some cases, however, an anæsthetic is necessary; while it is often highly advisable, not only in order to relieve pain, but also to abolish muscular resistance, and so limit the amount of force that is used. The movements described often succeed on the first trial, but they may have to be repeated once or twice; or they may have to be varied, extension being made while the foot is strongly everted or inverted, or while the tibia is abducted or adducted. Instances have been recorded in which reduction could not be effected, though repeated attempts were made. This is easily understood when such cases as 5, 6, and 7, related at pp. 270, 271, are borne

in mind. Still, with the help of an anæsthetic the displacement can very generally be corrected. Should the first trial fail, it should be repeated in a few days, when the joint has become cool. Often, when reduction takes place, a distinct "snap" is felt or heard. But often, again, this is not noticed, and the reduction of the displacement is only known to have been effected by the disappearance of all resistance to full extension of the leg.

2. In some cases, in which, in a sound joint, one of the cartilages becomes displaced as the result of a strong wrench, or a twist of the leg upon the thigh, but without laceration of the cartilage or of its attachments, the cartilage, either spontaneously or under manipulation, may go in with a snap, and the displacement may never recur. Very frequently, however, as the result either of more or less laceration, or relaxation of its connections, the cartilage slips from time to time—sometimes several times a day, sometimes only once in three or four months—and in these circumstances rest and the clamp shown (Fig. 43) should be employed. It scarcely shows if the trouser is cut a little full at the knee. I have used a clamp in a number of instances, and in a large proportion of the slighter cases it prevents displacement.*

The period during which it must be worn will vary with the case. When displacement has followed partial laceration of the connections of the cartilage, if a renewal of the slip is prevented for six months the torn structures may heal, and at the end of this time the support may be discarded. The same may be the case when the attachments of the cartilage have become relaxed during synovitis which has passed off. In instances, on the other hand, in which laceration has been

* The clamp shown (p. 275) is made by Mr. Ernst, Charlotte Street, Fitzroy Square, W.

extensive, or in which the joint is the seat of chronic change, the clamp may have to be worn for a more extended period. I have known several patients recover after using the clamp for eighteen months or two years. In severe cases, if operation is contra-indicated or refused, side extension-rods passing down from the clamp, to fit into the heel of the boot, may with advantage be added, to limit rotation of the tibia when the leg is flexed.

While the clamp is in use it is of the greatest importance that the nutrition of the limb and the tone of the muscles should be kept up by douches and massage. In the young and those whose circulation is feeble, hot douches are preferable to cold. The muscles of the thigh must be massaged daily, and the patient himself should, while sitting on the bed, support the thigh with both hands, used as a sling, in the popliteal space, and practise flexion and extension of the leg through the full range of those movements.

Strenuous exercise, such as tennis, cannot be safely indulged in; but cycling may, if care is taken in mounting and dismounting. The clamp need not be worn at night unless the slip has occurred while the patient has been in bed.

Operative treatment.—In cases in which the normal attachments of one of the semilunar cartilages have been extensively lacerated, so that displacement is frequent and causes serious inconvenience, and in which the clamp has been tried and has failed, or cannot be worn on account of the occupation of the patient, operation should be advised.

This advance we owe to the late Professor Annandale, who in 1883 exposed and sutured a lacerated internal cartilage. Subsequent operators, myself among the number, found that after suture relapses were apt to occur; while experience has shown, first, that the

operation for removing the cartilage, if aseptic, involves no risk ; secondly, that the loss of the cartilage is followed by no impairment in the functions of the joint.

The incision employed may be transverse, vertical, or semilunar. I have used the transverse. This extends, for the internal cartilage, from the inner margin of the ligamentum patellæ backwards over the interval between the femur and the upper border of the tibia, as far as the anterior border of the internal lateral ligament. Any hæmorrhage from the superficial vessels, which is sometimes free, must be checked before opening the joint. The cartilage is most easily recognised at the centre of its circumference, and the best guide to it is the upper border of the tibia. Further forward the cartilage is overlapped by subsynovial fat, and is much more difficult to find ; in the search for it a piece of tough, fatty tissue may be dragged up to the surface, and mistaken for the cartilage in a state of fibrous degeneration. The incision into the joint is made about half an inch above and parallel to the upper border of the tibia. With the leg flexed the cartilage can then be inspected, as it lies on the tibia. If it is found that the cartilage is detached at the periphery or at either extremity, or if the coronary ligament is so lax that it allows considerable play to the cartilage, then an incision is made at the lower border of the cartilage, so that the cartilage can be clamped with pressure-forceps and securely held during removal.

It is then isolated and divided as far back as possible, so that no portion of cartilage is left which could subsequently become nipped between the bones. Great care must be taken, in getting access to the posterior portion of the cartilage, not to damage the internal lateral ligament. If it has been divided at its anterior edge it must be carefully sutured. Cases have, it is said, been met with of knock-knee resulting after

removal of the internal semilunar cartilage, owing to division, and subsequent weakness, of this lateral ligament. All bleeding-points must be most carefully dealt with, and the capsule closed by suture. No drainage should be employed, and somewhat firm pressure should be applied. A splint is not essential, but is advisable for a week or ten days until the stitches are removed. After this, massage and passive movements should be carried out, and in three weeks the patient should be able to use the limb.

The possibility that sepsis may occur, and the magnitude of such a calamity, indicate clearly enough that the operation should not be undertaken until its necessity has become apparent. Probably not more than about 10 per cent. of the cases demand operation. Each case, however, must be separately judged with special reference to the occupation of the patient and the severity of the symptoms. In properly selected cases the results are excellent, and when asepsis has been secured no impairment of the joint remains. It may occasionally happen that the joint slowly fills with blood after the operation, and is painful; if this should occur, as in one of my cases, the joint should be reopened and washed out in order to avert loss of movements by the formation of adhesions.

Dr. James Bell * has described three cases of luxation of the internal, and one of the external semilunar cartilage, in which reduction could not be effected. The joint in each case was opened by transverse division of the patella, and the cartilage was found to be torn from its connections, "crumpled up," or "rolled up like a scroll," and lying in the intercondyloid notch, so that the condition was similar to that described in the cases mentioned on pp. 270, 271. Although for the removal of a cartilage which has not been widely

* *Brit. Med. Journ.*, Nov. 10, 1906.

displaced so extensive an operation is not called for, yet the proceeding is one which may well be adopted in such instances as those described by Dr. Bell. I have several times made use of this method when a full examination of the knee-joint is required, and I regard it as the best proceeding to adopt when an accurate diagnosis of some internal derangement cannot be made without a full inspection of the joint.

CHAPTER XX

ANKYLOSIS

It is important not to confound ankylosis—that is, the union of articular surfaces by either fibrous tissue or bone—with various other conditions by which the movements of a joint may be interfered with. The two cases are essentially different, and the failure to distinguish between them may lead to serious errors in practice. In the one, the formation of ankylosis involves the destruction of the joint, and the partial or entire obliteration of its cavity. In the other, although stiffness is complete, all the essential structures of the joint may be either intact or but slightly involved, the obstruction to movement being seated entirely in the surrounding parts. Mere stiffness, imitating ankylosis (and sometimes termed spurious ankylosis), may be due (*a*) to muscular spasm, of which the best instance, perhaps, is the rigidity often present in incipient hip-disease, and which may be so marked that the femur and pelvis move as one piece. It is also well illustrated at the shoulder. When disease is still in its early stage, this joint is often so stiff from muscular spasm that any movement of the humerus is at once conveyed to the scapula. Muscular spasm is seen, again, in hysterical contractions (p. 499 *et seq.*); in some instances it follows sprains and other injuries. Or stiffness of a joint may depend (*b*) on the presence of adhesions in the surrounding soft parts, due to inflammation produced by injury or rheumatism. Such adhesions are especially common amongst the muscles surrounding the shoulder-joint.

If care is taken, the distinction between true ankylosis and mere stiffness depending on conditions external to a joint can seldom be difficult. The patient's history is different in the two cases. In instances of ankylosis there is generally an account of either acute or prolonged inflammation of the joint itself (but *see* p. 70); while if stiffness depends on conditions external to the joint there is a history either of some accident, of a slight inflammatory attack, or of merely incipient disease of the joint. Examination often shows that, though at first sight the joint may seem to be absolutely fixed, this is not really the case, but some movement remains between the articular surfaces. Thus, to take the case of stiffness of the shoulder due to some cause external to the joint: although when the humerus is widely moved the scapula moves with it, yet when the humerus is carried gently through a limited range backwards and forwards, or when it is rotated on its long axis through only two or three degrees, some natural movement, though it may be very limited, is detected at the joint. If the patient is examined under an anæsthetic, any stiffness that is due to muscular spasm will disappear, while, should rigidity depend on external adhesions, a very slight amount of force tentatively applied will often suffice to rupture some of them, and the nature of the case will become clear, not only from the fact that the adhesions, as they give way, are felt to be outside the joint, but from the immediate restoration of considerable movement. The treatment of muscular spasm must, of course, depend on the cause. If it results from incipient disease of the joint, treatment must be directed to this condition (p. 441). If it is due to hysteria, the remedies for this affection must be employed. The treatment of adhesions external to joints is given at p. 536.

We may now turn to ankylosis itself. This may be

fibrous or bony, or, as is often the case, these two forms may be met with in different parts of the same joint (Fig. 44).

Fibrous ankylosis varies widely in its extent. In some instances, scarcely deserving the name, it is limited to a small patch of adhesions at some part of a joint

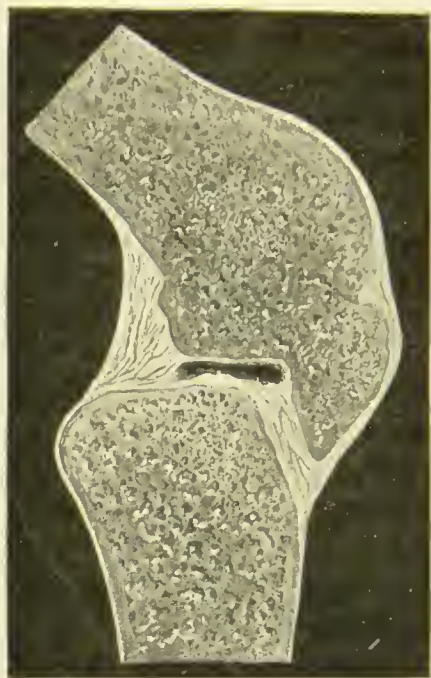


Fig. 44.—Ankylosis of the knee-joint, partly fibrous and partly osseous. The tibia has undergone displacement backwards.

(From a specimen, No. 639, in St. Bartholomew's Hosp. Mus.)

that has otherwise returned, after inflammation, to a healthy state. In others, the whole cavity has become obliterated by the formation of dense short-fibred adhesions co-extensive with the original articular surfaces (Fig. 45). It is often difficult to estimate the extent to which adhesions have formed. The best guides as to their amount are the severity and the duration of the antecedent disease. In cases of acute suppurative

arthritis, and also in some of the more rare examples of rheumatic inflammation, or again in infective arthritis (p. 124), complete ankylosis has been found to occur in the course of four or five weeks. In other cases, fibrous ankylosis takes place from long-continued inflammation of a subacute type. This result is often met with in the form of tuberculous arthritis, and it is also well illustrated in cases of arthritis occurring



Fig. 45.—Fibrous ankylosis of the hip-joint. Dense fibrous adhesions everywhere unite the two surfaces of the bones, so that there is only very slight movement between them. The head of the femur and the acetabulum are denuded of cartilage, and the bone is superficially eroded. From a child, aged 8. No sup-puration had at any time existed in connection with the hip-disease. Death resulted from general tuberculosis.

(From a specimen, No. 627A, in St. Bartholomew's Hosp. Mus.)

in puerperal septicæmia (p. 135). It is, nevertheless, often impossible to form a correct a priori estimate as to the extent of adhesions present in a joint. Sometimes they are extensive when inflammation has been comparatively slight; in other cases they are limited although inflammation has been either acute or prolonged. The only reliable course is to make a

careful examination when the muscles have been relaxed by giving the patient an anæsthetic.

Treatment.—The first step in the management of a case of fibrous ankylosis must be to keep the joint at rest until all inflammatory action has ceased. Neglect of this principle has often led to mischievous results; for forcible movement of a joint which is still or has recently been inflamed will induce renewed irritation, and further exudation of lymph, with the result that the stiffness already present will be increased. These are among the cases which have brought the manipulation of joints into undeserved discredit. If rest is maintained till the joint is quite free from abnormal heat, and till swelling has mainly subsided, or till it is noticed that no further reduction of swelling is taking place, the condition of the joint may safely be investigated. If the adhesions prove to be limited in extent, so that movement is restored with the use of slight force, passive motion may be subsequently employed, provided the joint does not become, or at least does not remain, abnormally hot, and is not painful or swollen. In such cases very good results are often obtained. On the other hand, if moderate force does not restore movement, or if, when force is used, extensive intra-articular adhesions are found to be giving way, it is generally useless and inadvisable to proceed farther. To do so is to tear through the cicatrix by which the joint has been replaced, and the only result that can follow such a proceeding is either the re-formation and extension of the cicatrix, or a renewal, in perhaps an active form, of the original inflammatory process. In such instances, much as we may regret the conclusion, the best course is to advise the patient to regard a stiff joint as inevitable. This is, I am convinced, the proper advice to give in cases in which joints are left stiff after tuberculous disease. I do not remember ever

to have seen manipulative interference restore movement in a joint that was the seat of fibrous ankylosis following tuberculosis. Tempting as it may be to use manipulation in these cases, it ought not, I believe, to be resorted to.

In instances in which a joint has become ankylosed by fibrous adhesions in a position of deformity, it is sometimes advisable, when all disease has come to an end, to use forcible movement in order to place the limb in a more servicable posture. Such a proceeding demands great care. It must be conducted with strict regard to the particular circumstances of each joint, and the surgeon will do well to remind himself of the natural extent of different movements by testing them on the corresponding sound joint. The operation can very seldom be called for in the shoulder, for this joint is unique in the fact that, even when the seat of severe or prolonged disease, it undergoes no deformity. If, however, force is to be used, the humerus should be rotated on its long axis in the glenoid cavity before any attempt is made to bring the arm away from the side; while the attempt to raise the elbow towards the level of the head must either be entirely avoided or must be most cautiously carried out, for otherwise the vessels, or the brachial plexus, may be seriously injured. In moving the elbow, the surgeon should always flex before he extends the forearm. Flexion should also always precede extension at the wrist. In the case of the hip, the femur should invariably be flexed upon the pelvis, abducted, adducted, and rotated on its long axis before any attempt is made to extend it. The danger of forcible extension of the hip has reference not so much to injury of the vessels as to the probability that, if the head of the femur and the border of the acetabulum have been partially absorbed, the force used may have the effect of

dislocating the femur upwards and backwards on to the dorsum ilii. It must also be remembered that the femur constitutes a very long lever, and that if violence is used the neck or shaft of the bone may be fractured. Before attempting to flex the knee-joint it must be ascertained that the patella has not become adherent to the condyles of the femur. If this investigation is neglected, the ligamentum patellæ may be torn across. Extension must be cautiously practised, not only because the popliteal vessels may otherwise be in danger, but because dislocation of the head of the tibia into the popliteal space is very likely to be produced.

In the case of the knee, as in that of the hip, division of such of the tendons as are felt to be tense may be required. But in the instances of both these joints position is usually better corrected by gradual than by immediate force (*see pp. 518-521*). The ankle may be forcibly flexed without danger, but division of the tendo Achillis may be required as an accessory measure. In cases of fibrous ankylosis in which forcible movement has been employed to alter the position of a limb, there is usually a strong tendency for the deformity to return, and it is therefore necessary that adequate retentive apparatus, consisting either of plaster-of-Paris, well-padded splints, or weight-extension, should be employed.

Bony ankylosis.—This is generally the result of suppurative arthritis, which may have been either acute and of short duration, or less acute and more prolonged. In an acute arthritis it is occasionally produced very rapidly. In a case in which death had occurred from pyæmia following acute arthritis of the ankle-joint, resulting from infective osteo-myelitis of the lower end of the tibia, I found on post-mortem examination, just a month after suppuration had commenced in the joint, that the surfaces of the tibia and astragalus

were already firmly united by new tissue, in which ossification was very nearly complete. Typical instances of bony ankylosis, after prolonged suppurative arthritis, are met with in hip-disease, in the course of which the joint may become, as repair slowly advances, completely fixed (Fig. 46). Although, however, bony ankylosis is one of the obvious results of suppurative arthritis, the opinion formerly entertained, that when suppuration has occurred in a joint, bony ankylosis is the only method by which repair can take place, is now known to be erroneous. Cases are not uncommon in which, notwithstanding that suppuration has been both copious and prolonged, recovery ensues with the preservation of very considerable movement. Indeed, I have met with several instances in which movement was quite perfect, and I have been led



Fig. 46.—Bony ankylosis of the hip-joint.

(From a specimen, No. 649, in St. Bartholomew's Hosp. Mus.)

to the conclusion that, instead of being the almost constant rule, it is the exception for suppurative hip-disease to be followed by bony ankylosis. Doubt has long prevailed whether bony ankylosis ever takes place in cases in which there has been no suppuration. That it does occur, however, is shown by the following case, for which I am indebted to Mr. Walter Roughton:—

A girl of 18 had had disease, apparently tuberculous,

of her elbow, of several months' duration. The joint had never been painful, nor more than slightly swollen. No suppuration had occurred, and no splint had been used. The elbow was quite fixed at an angle of about 130° . On excising the joint to render the limb more useful, Mr. Roughton found that bony ankylosis had taken place. Further allusion is made to this subject in a paper in the *Lancet* (November, 1905, p. 1389), in which I stated: "I have several times found knee-joints, the seat of tuberculous disease, which, apart from suppuration, had become so completely fixed within six months as strongly to suggest the conclusion that bony ankylosis had taken place; and the remarkable fact has been, that nothing more has been seen of any active tuberculous disease. The explanation I would suggest is that in some individuals a joint, instead of falling an easy prey to tuberculous invasion, becomes, as the result of the irritation which the bacillus produces, the seat of a plastic inflammation similar to that which produces ordinary callus, and it is by this process that the joint-surfaces are firmly united. In the meantime the bacillus, enclosed in an area of diminished vascularity, perishes, and the tuberculous process is brought to an end. This speedy and, as it may be termed, natural cure of tuberculous disease by plastic inflammation may well be set against the inconvenience of the ankylosis by which it is attended." It is impossible to prove the existence of this condition till a longitudinal section of the bones has been made. But I have seen many non-suppurative cases after acute rheumatism and infective arthritis, in which the joint had become so fixed that not the slightest movement could be detected when the patient was fully under the influence of an anæsthetic, and in which I believe bony ankylosis had occurred.

Figs. 47 and 48 represent two remarkable skeletons



Fig. 47.—Bony ankylosis of the foot.

(Mus. of Cambridge University.)

of feet in the museum of the University of Cambridge. My attention was drawn to them by Dr. Joseph Griffiths. These feet are the seat of almost universal bony ankylosis, owing to the fact that the superficial surfaces of the different bones are covered with vegetations and

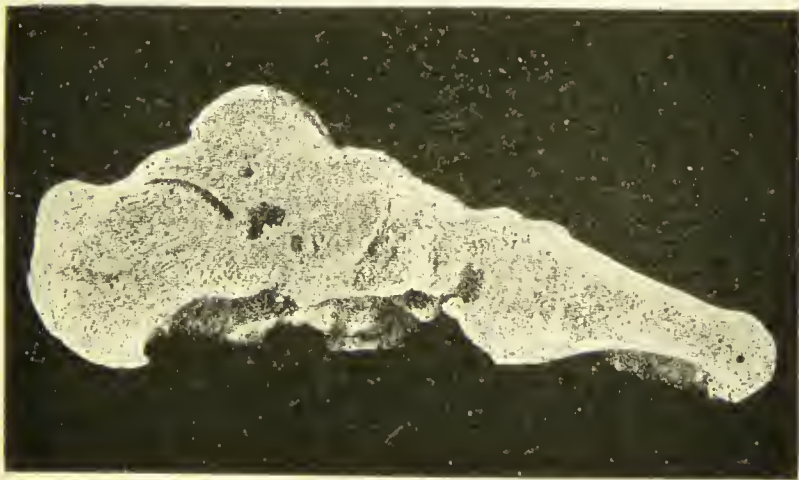


Fig. 48.—Bony ankylosis of the foot. Some of the tarsal joints are obliterated, but others are little changed, and ankylosis is due to the formation of plates and vegetations on the surface of the bones.

(Mus. of Cambridge University.)

continuous bony deposits, which bridge over the interval between them. On section, however, it is discovered that some of the joints themselves are little changed. Their cavities can still be traced, and even the articular cartilages can be recognised. Some of the tarsal and phalangeal joints, however, have undergone such complete synostosis that no vestige of their cavities remains. The history of the cases from which these specimens were derived is unfortunately unknown. I have never seen such conditions before. How are the appearances to be explained? At first sight they might be attributed to suppuration—probably of septic origin. But, in the first place, there is very little alteration in shape, and very little erosion of the bones, such as would be expected in widespread and prolonged suppuration; secondly, many of the joints are but little changed—yet in septic cases it is upon the joints themselves, through their synovial membranes, that the main stress falls; thirdly, the sesamoid bones of the great toe are much increased in size—a change that, so far as is known, would not be produced merely by inflammation, even if it went on to suppuration.

It is of the highest importance, when a joint is seriously diseased, that mechanical treatment should be adopted, by which deformity may be prevented. The difference as to usefulness between a limb in which bony ankylosis has taken place in a favourable position, and one in which deformity has been allowed to occur, is sufficiently obvious. In the one case, the patient has recovered with a limb that, in many instances, is scarcely less serviceable than a natural limb; in the other, the reparative process has been expended in vain, the patient is crippled, and the only means of helping him is to perform osteotomy or excision.

Treatment:—Bony ankylosis with deformity may be treated in various ways.

Our resources in this field have been largely increased by the introduction of osteotomy. It is now well known that when precautions against septic infection are taken, bones thus divided unite with both safety and facility. Indeed, we have in osteotomy a method, applied to the skeleton, very similar to that applied to the muscular system in the form of subcutaneous tenotomy. In other words, deformities of various parts of the skeleton are now treated by division of the bones that are at fault, just as deformities due to contracted muscles are corrected by tenotomy.

1. When there is no displacement of the articular ends, and it is only necessary to alter the angle at which the joint has become fixed, it may be sufficient to introduce a chisel in the line of union, and divide the connection between the two bones. A few years ago a man was in St. Bartholomew's Hospital with bony ankylosis of his ankle-joint, in a position of talipes equinus, following acute pyæmic arthritis. As he was unable to bring his heel to the ground, and as walking on his toes was very painful, I made a small incision through the skin in front of the ankle, just externally to the tendon of the peroneus tertius, introduced a fine chisel in the line between the tibia and astragalus, and divided the bony union. I was then able, after cutting the tendo Achillis, to bring the heel well down. The patient made a good recovery, and three months later could walk easily on the foot.

2. Sometimes this proceeding of simply chiselling through the line of union may afford good results in the case of the knee. Usually, however, it would be found impossible to extend the tibia upon the femur, owing either to displacement of the bones on each other, or to the presence of strong adhesions at the back of the joint. In these cases excision is the better operation.

3. In the treatment of ankylosis of the hip, attended with deformity, osteotomy may be performed either through the neck of the femur, or through the shaft immediately below the trochanters. In the former proceeding, as the neck of the femur is likely to be altered in both shape and direction, I have made an incision at the back of the joint, three-quarters of an inch in length, just above the great trochanter, have passed in my finger to ascertain the position of the neck, and have then with a chisel divided the bone in this situation. Complete extension, however, has not been immediately carried out, but the limb has been gradually brought down with the weight and pulley, as described at p. 441. This course has been adopted as being free from violence, and as avoiding the result, which might follow forcible extension, of causing the end of the femur to slide upwards and backwards on the dorsum ilii. The objection that might be raised to division of the neck of the femur, namely, that if the bone has been involved in tuberculous disease it is unsuitable for operative treatment, has not been confirmed by experience; in none of the cases has there been failure to obtain good repair.

4. In ankylosis of the hip-joint, Mr. W. Adams's operation of subcutaneous division of the neck of the femur by sawing through the bone will generally yield a favourable result in appropriate cases. The operation, however, is only suitable when the neck remains of nearly its usual length. This proceeding is one with which the surgeon should be careful thoroughly to familiarise himself, by practice in the dead-house, before attempting it on a living subject. Mr. Adams gives the following directions:—"The left thumb is placed firmly so as to compress the soft tissues against the bone, at a point situated at the centre of the top of the great trochanter, and the breadth of one finger above it. At

this point the narrow-bladed knife* is pushed in till it reaches the neck of the femur at a right angle, across the front of which it is then carried. The knife is then gently moved to cut a space for the easy insertion of the saw, which, traversing the course of the knife, reaches the front of the neck of the femur, and gradually cuts it completely through. The surgeon cuts until he feels that the saw is free of the bone, and moving in the soft tissue only, behind the bone." From what I have seen of these two operations, (3) and (4), I am inclined to think that the first-described may be advantageously used in children, but that in the case of the larger and stronger bone in the adult, if the neck of the femur is still present, Mr. Adams's method is to be preferred.

5. In cases in which disease of the hip-joint has been extensive, so that the neck of the femur has been lost, and the upper end of the bone has undergone displacement upon the dorsum ilii, where it is embedded in an extensive deposit of lowly-organised new bone and cicatricial tissue, it is best, especially if ankylosis is attended with considerable deformity, to divide the femur just below the trochanters. An incision three-quarters of an inch in length is made on the outer side of the limb through the soft parts down to the shaft of the femur just below the level of the lesser trochanter. A chisel, or, as some prefer, a saw, is then introduced, and the bone is so far divided that it will easily give way when the limb is sharply adducted. Division of the bone should be mainly effected by the chisel or saw, so that the fracture may be transverse. The limb should be gradually brought down by weight-extension (p. 441). In a long series of cases in which I have resorted to this procedure, a favourable result has been secured. The operation is easily performed, and is, so far

* The special instruments used by Mr. Adams are described in a pamphlet on the operation, published in 1871.

as I have seen, free from all material risk. Bony union is the result, and I should very strongly hold that this condition is far preferable to any form of ligamentous union, or a false joint. When ankylosis is present at the hip, no return of deformity can occur, while with a false joint deformity would be extremely apt to develop when weight was thrown on the limb.

Bony ankylosis combined with deformity, in the case of the elbow, is best treated by excision, for by this operation a movable false joint will usually (if sufficient bone is removed—p. 314) be secured—a result that cannot be obtained by osteotomy alone.

CHAPTER XXI

EXCISION FOR TUBERCULOUS DISEASE

Historical.—The history of excision of the joints may be briefly sketched. The knee was excised by Felkin in 1762, and by Park in 1781; the shoulder by Bent in 1771; the ankle by Moreau in 1782; and the hip by Anthony White, of the Westminster Hospital, in 1818. These proceedings, however, were isolated efforts which bore no immediate fruit. They were, indeed, so severely criticised by the surgeons of the day that the operation was discarded, and apparently forgotten until it was revived many years afterwards by two great leaders of surgery, Syme and Fergusson. Syme, in 1826, performed excision of the shoulder and of the elbow; and Fergusson, “notwithstanding early prejudices, ventured in July, 1850, to perform excision of the knee-joint on the living body.” The case, however, ended in disaster; “violent inflammatory fever set in before three days had elapsed, and death occurred on the ninth day,” evidently from septicæmia following osteo-myelitis of the ends of the bones. Fergusson, though keenly distressed at this result, was not discouraged, but remained a warm advocate of the operation. It was repeated by his pupil, Jones, of Jersey, early in 1851, and subsequently by other surgeons so frequently that upwards of a hundred cases occurred in the course of the next seven years.

In the period that has elapsed since 1850 ample experience of excision in its application to all the large joints has been obtained. In former days, when wounds

became septic almost as a matter of course, the results of the operation left much indeed to be desired. Cases were not rarely fatal, while in many others amputation had to be subsequently performed. Excision was, nevertheless, as Fergusson, with justifiable enthusiasm, always regarded it, a great advance in the direction of conservative surgery. The immediate result of its adoption was to reduce very largely the number of amputations for joint-disease, and it was a long step forward upon the road on which such great progress has lately been made.

With the introduction of aseptic surgery, excision entered upon a new phase, and operators found that they were standing on new ground. It became possible to excise the large joints without suppuration, and to obtain primary union. This point reached, a strenuous effort was made between 1870 and 1885 to deal in some more satisfactory manner with tuberculous diseases of the joints. The object was not only to reduce the mortality of these affections, which in the case of the hip was shown by statistics to be between 30 and 40 per cent., but to limit the period over which the cases extended. For this purpose excision was employed on a large scale. It was, however, soon found that, when the operation was performed in cases in which septic inflammation had led to suppuration and extensive bone-disease, the results of excision were very discouraging. In a large proportion of instances the disease was not arrested, but continued to advance much as it had done before the operation was performed. Thus it was seen that if the results of excision were to be satisfactory, the operation must be undertaken at a much earlier stage, and before septic processes had become established. Moreover, Koch's discovery of the true nature of tuberculosis formed a new epoch in the history of excision. As the disease was now known to be parasitic in origin, and not only to have a tendency to spread locally, but also to

lead to systemic infection, resulting in the development of acute general tuberculosis, it appeared to many surgeons that the proper method of treatment was to eradicate the disease by the early and complete excision of all the structures that were involved. In accordance with this view excision was extensively employed in England, as well as on the Continent and in America, as the routine treatment of tuberculosis of the joints when the stage of caseation was believed to have been reached. Some surgeons even performed the operation still earlier, and one case came under my notice in which a hip-joint was excised within three months of the first appearance of the disease !

It was probably inevitable that, having on the one hand to deal with such an affection as tuberculosis of the joints, and, on the other, having recently come into the possession of such enlarged powers as were conferred by the aseptic method, surgeons of a progressive temperament should give the operation an extensive trial ; in other words, that in the process of evolution the surgery of the joints would pass through the "excision age." This excision period extended, roughly speaking, over the ten years between 1875 and 1885. During this period the operation was performed in a very large number of cases, and ample materials were provided for a judgment of its merits. The immediate results of the operation itself showed a striking advance upon former experience, and left little or nothing to be desired. As a rule, primary union of the wound, in the case of both the hip and the knee, was secured, so that within a few weeks the patients were able to be about with the limb protected by a suitable apparatus. This was a very material advantage, and, could the operation have been judged by this standard alone, excision would undoubtedly have ranked as one of the greatest achievements of modern surgery. It was evident, however, that

the mere healing of the wound was not enough. In order to obtain a correct estimate of the operation, several important considerations had to be taken into account.

1. The principle of the operation is easily grasped. It is the cutting away of a part instead of the cure of the disease in which the part has become involved. It is like removing a tooth, an eyeball, or a testis, instead of curing the disease by which these organs have been attacked. However favourably or safely repair may be accomplished, the fact remains that the patient has suffered the loss of an important organ. Of course, this principle may be perfectly sound in some instances, and the treatment the best that can be adopted; but certainly it is not the principle that has guided recent progress in other fields of surgery, where every effort has been made to preserve the structures of the body, and to turn to the best account any which, although impaired, are yet not irreparably damaged.

2. Although in some cases tubercle, during its early stages, is mainly or entirely confined to the synovial membrane, yet it is frequently deposited in the cancellous tissue of the articular ends of the bones in the immediate neighbourhood of the epiphyseal lines, so that any proceeding for the free removal of the disease must entail either the complete sacrifice or the serious injury of the line of growth, and the consequent arrest, in the case of the knee and shoulder, of the further due elongation of the limb. The full force of this objection is apparent when it is remembered that the majority of cases of tuberculous joint-disease begin in children between the ages of three and ten.

3. In early life the ends of the bones are imperfectly ossified, so that in the case of the knee union does not occur by firm synostosis, and subsequent bending is very likely to occur.

4. As experience of the operation increased, it became

clear that the ultimate condition of the limb was unsatisfactory. After excision of the hip, in the early stage, the patients, in the majority of cases, were found to be very lame, and, in many, considerable deformity was developed. After excision of the knee the limb was short and weak, and often became flexed and to a great extent useless. And it must be remembered that by the results obtained in these two joints, excision as an operation for common use must stand or fall. No doubt the drawbacks mentioned above apply with less force to excision of the joints of the upper extremity. As to the elbow, the ends of the bones which form it are not the ends in which growth in length of their respective shafts mainly takes place, so that even a free removal of bone does not materially interfere with subsequent increase in the length of the limb; and further, the upper extremity, although after excision it is shorter than its fellow, may still be efficient and useful. The exact symmetry of the two upper limbs is comparatively unimportant. Even after excision of the shoulder, although the limb is materially shortened, it may yet be very serviceable. Excision of the shoulder for tuberculous disease is, however, rare. As to the wrist, while the laying-open of sinuses and removal of dead bone and diseased synovial membrane is sound surgery, a planned excision of this joint is so rare that it need be no further alluded to than to say that, although it is occasionally satisfactory, the usual result is not encouraging.

5. During the period mentioned, 1875-1885, the life history of the *Bacillus tuberculosis* was carefully studied, with the result that this micro-organism was pronounced both by pathologists and clinical observers to be of low vitality, and largely dependent for its development and growth on fitness of soil. Moreover, it was found that much of this fitness of soil consists in conditions and

influences which are either in their nature transitory, or which can be counteracted or removed, and that when these conditions are no longer present, the bacillus perishes and the tuberculous process comes to an end. That fitness of soil is transitory appears from the fact that, in a large majority of instances, tuberculosis of the bones and joints begins between the ages of three and ten, and that frequently children in whom, during this period, tuberculosis has assumed a severe form, afterwards completely recover and remain free from any further development of the disease. As to conditions which can be counteracted or removed, these are found in such defects of the general health as are induced by unfavourable surroundings, or which follow the exanthemata, especially measles. That, in the absence of favourable conditions, the bacillus often perishes has been established by numerous observations. The evidence adduced on this subject by Dr. Ransome, in his lectures on "The Etiology and Prevention of Phthisis," is typical of much that has lately been recorded. Having quoted the view of Sir Thomas Watson, that "tuberculous disease, when established, is beyond our power," he continues: "These views . . . of the incurability of phthisis are now altered; for not only does clinical evidence show a considerable percentage of cure or improvement under judicious treatment, but the evidence of post-mortem examination of adults who have died of diseases other than phthisis shows that a very large percentage of persons have suffered, and recovered, from tuberculous disease of the lungs." And he quotes the late Dr. Moxon's view that "the life of the bacillus parasite is difficult, and easily discouraged by unfavourable circumstances, like an aphid by an easterly wind."

Another point on which pathological research and clinical observation were found to be completely in

accord is that, when by unfavourable conditions the life of the bacillus has been brought to a close, its products become a mere *corpus mortuum*, to be either gradually removed by disintegration and absorption or to give rise to an abscess with the evacuation of which they are clean swept away. When this clearance has been effected, the structures concerned, relieved of the parasitic element, are left to undergo sound repair.

When the evidence under these various headings was examined, it became apparent that neither the necessity nor the advisability of early excision as a means of eradicating the tuberculous process had been established. Nor could the proceeding be recommended when it was observed that the future usefulness of the limb was seriously impaired. Thus, this important question had been submitted to an exhaustive examination, in which the ablest surgeons of the day had taken a part, and a clear answer had been obtained. As a matter of fact, the great majority of those who originally employed the operation on a large scale, in early cases, afterwards gave it up. That tuberculous joint-disease can be successfully treated without excision, is shown by the fact that, among the children of the well-to-do, who can secure early treatment, the operation is practically unknown. Were excision the best treatment, many of the rich, among whose children tuberculous disease is frequently met with, would certainly avail themselves of it. In the fact that those who could most readily secure all the advantages which it has to offer are scarcely ever advised to accept it, we meet with the strongest proof that excision, when the patient's circumstances are favourable, can and had better be avoided.

The shoulder.—Excision of the shoulder-joint is but rarely performed in tuberculous disease, for, owing to

the readiness with which the movements of this joint are vicariously performed either between the scapula and thorax, or at the elbow, this articulation, when diseased, can be placed at rest ; and the inflammatory process is usually neither acute nor destructive. There is, moreover, no tendency to deformity. I do not remember ever to have seen this joint excised for tuberculous disease in childhood. A serious objection to the proceeding in early life is that, as the upper is the growing end of the humerus, and as the epiphyscal line is situated immediately below the head, the result of the operation must be to arrest the further growth of the arm. Even in the adult the operation is rare. Were the operation necessary it should be performed by making an incision from the outer side of the tip of the coracoid process downwards for about three inches in the line of the long tendon of the biceps and extending to the bone. In this incision the deltoid is uninjured. The margins of the wound are then retracted, and the long tendon of the biceps is hooked aside and carefully protected. The supra- and infraspinatus and teres minor muscles are separated subperiosteally at their insertion into the greater tuberosity of the humerus, the bone being for this purpose rotated inwards ; the subscapularis is then similarly treated, the humerus being, at the moment, strongly rotated outwards, and the point of the knife being kept as close to the bone as possible. The head of the humerus, when any remaining parts of the capsule have been severed, will now be exposed. It is protruded into the wound, and the neck is cut through just below it. The glenoid cavity is very rarely diseased, and may generally be left without interference.* A small drainage-tube may be inserted,

* Mr. T. H. Kellock has described a method of excising the shoulder-joint in cases where the head is not extensively diseased which allows the tendons attached to the tuberosities to be left

through a posterior counter-opening at the lower end of the incision. No splint is required, the arm being bandaged to the side, and the forearm and hand placed across the chest. Thus excision of the shoulder-joint usually consists merely in removing the head of the humerus. In the few cases which I have seen of excision of this articulation for other conditions, the result has varied. In some the arm has been wonderfully useful, and the new "joint" has been firm and has admitted of considerable movement. In others, however, movement has been very limited, and the arm has been so weak as to be virtually useless, though the movements of the forearm have been preserved.

The elbow.—Even at the present time cases occur in which tuberculous disease of this joint has been left without adequate treatment till the articulation has become disorganised and sinuses have formed. In many instances disease has begun in the bones, and has subsequently involved the joint, so that with the joint-affection there is combined extensive caries of either the lower end of the humerus or the olecranon process of the ulna. Although many of these cases would at length recover with long-continued rest, the best course, under the conditions in which the children of the poor are placed, often is to perform excision. The objections that apply to the operation of excision in the case of the hip and the knee are not in force here. That is, the proceeding is much more limited than it is in these large joints, and ligamentous union, easily obtained, is all that is required for the future usefulness of the limb. The shortening of the limb due to excision of the elbow is of very much less importance than is that which follows excision of the hip or the knee.

intact. The method consists in dividing the neck of the scapula and completely removing the glenoid cavity, combined with removal of only the head of the humerus (*Clin. Soc. Trans.*, xl. 94).

Excision of the elbow must be carefully performed, with the smallest possible injury or disturbance of the surrounding soft structures. Usually a single longitudinal incision is all that is required, and it is better to prolong this than to convert it into a T-incision by making a transverse cut running outwards from its centre. This longitudinal incision begins about two inches above the joint, in the middle line, and is carried downwards just internally to the tip of the olecranon, and continued for about two inches along the posterior ridge of the ulna. It extends to the bone. All the soft structures *en masse* are then very carefully turned off the internal condyle. The ulnar nerve embedded in them ought not to be seen. There is less danger of cutting this nerve as it passes behind the condyle (for every one is cautious here) than there is of dividing it below the joint; for on leaving the back of the condyle and entering the forearm the nerve turns a little outwards, and tends to approach the posterior ridge of the ulna; so that if the operator, after clearing the condyle, uses his knife freely an inch or thereabouts lower down, the nerve will be in imminent danger. When I was Demonstrator of Surgery I found that it was at this point that beginners usually cut the nerve. The accident may be avoided by keeping the knife close to the bone and never thrusting its point out of sight deeply into the muscles.

Another important point is that the anconeus muscle should be preserved. In the operation by a T-incision not only is the connection between the triceps and the ulna divided (this cannot, of course, be avoided, since the olecranon is removed), but the anconeus, when the transverse incision is made, is cut across. The result is that the patient is left without any extensor of the forearm, and thus in many instances, though other movements are regained, and the forearm is strong, the power of extension is very defective. If, however, the

anconeus is saved and turned off the ulna to a point just below the olecranon, but no farther, and is then retracted, it will subsequently, by undergoing development, constitute an extensor of considerable power. Some years ago the late Mr. Maunder showed a patient at one of the societies on whom he had thus operated, who could strike a heavy blow with the forearm.

When the soft parts have been so far detached that the olecranon is exposed, this should be removed with a saw or cutting forceps; and then the lower end of the humerus should be removed. As soon as the wound has healed, and the soft parts are free from considerable swelling, the patient may be allowed to be up, to leave off the splint, and gradually use the limb. Free movement will often be regained. But, in order to secure this, there should be an interval of about half an inch between the ends of the bones when the limb is placed on the splint. This interval may usually be provided by drawing the forearm a little way from the arm; but if during the operation, when the bones are brought into position, it is found that they are in contact, it is better to remove a further portion.

The wrist.—Excision of the wrist for tuberculous disease is seldom required. So far as I have seen, this joint is very amenable to treatment by well-fitted leather splints constantly worn. If splints are applied in the early stage, it seems to me to be no exaggeration to say that recovery may be very confidently reckoned upon. Perfect movement is usually preserved. At least, I have seen this result over and over again. In neglected cases, which have gone on to suppuration and caries, prolonged rest will still, without doubt, in the great majority lead to sound repair. But when sinuses have formed, and are lined with tuberculous granulation-tissue, and when the soft parts have become widely septic, prolonged rest may fail, and some operative

interference then becomes necessary. In such cases I have seen much better results obtained by following up fistulous passages, scraping away granulation-tissue, extracting the individual carpal bones that are found either necrosed or extensively carious, and cutting away pulpy synovial membrane, than by performing a systematic excision. I have, it is true, seen a few excellent results after complete excision of the wrist; but these have been far outnumbered by instances in which, though sound healing has been secured, the hand has been almost useless. Thus, I would strongly urge that excision of the wrist should only be resorted to when every other means short of amputation has been fully tried and has failed. In many cases that looked hopeless when first seen, the splint treatment, combined if necessary with scraping, has been followed by improvement, and improvement by ultimate recovery.

Excision of the hip.—This operation becomes more and more rare as surgery advances. Now that tuberculous disease is detected early, and treated on the open-air system and by continuous rest, recovery, without serious damage to the joint, is the rule. Even in the cases in which disease is more advanced, and suppuration has occurred, aseptic evacuation of pus and flushing of the joint-cavity will be followed by primary healing and ultimately by sound repair. Indeed, on several occasions, I have known patients after abscess recover with perfectly free movement. In mismanaged or neglected cases which have become septic, and in which sinuses have formed, the joint should be explored, and if the head of the femur or the acetabulum is found to be carious, the head should be removed so that free drainage is secured and damaged structures are got rid of. Yet the operator should lean to the conservative side, and remember that the smaller the amount of bone removed the less will be the shorten-

ing, and the firmer and more serviceable will be the joint for future use.

Bowlby* has recently reported on 900 cases of tuberculous disease of the hip under his care at the Alexandra Hospital with a mortality of only 4 per cent. In none of these cases did he find it necessary to resort to excision.

Thus excision of the hip, in the future, will in all probability occupy a limited field. For early cases it is now discarded : in the first place, because such cases, when they are adequately treated, do well, in the great majority of instances, without operative interference ; and, secondly, because when excision is withheld the limb is a much better one than when the operation has been performed. The operation will probably henceforth be reserved for (a) cases in which suppuration is combined with considerable deformity. Here the operation will secure the double advantage of removing septic bone and of effecting an improvement in the position of the limb. (b) Cases of extensive bone-disease, whether of the upper end of the femur or of the acetabulum, attended with chronic suppuration. Here excision is often followed by rapid healing, and the arrest of the disease ; while, in many instances, a serviceable limb is obtained. Fortunately, however, both these groups are steadily diminishing in number, and, as the proportion is increased of instances in which treatment by rest is adopted early, the necessity for excision at a later period will become less and less frequent.

In former years it was observed that the operation of excision was not rarely followed by the speedy development of acute general tuberculosis. This result is easily explained. In the undisturbed condition of the parts the tuberculous products are walled in by inflammatory exudation, which affords a barrier against systemic

* *Brit. Med. Journ.*, June 20th, 1908, p. 1470.

infection. When, however, in the operation of excision the cancellous spaces were laid open, and, as was then the practice, the wound was left charged with tuberculous material, absorption through these open spaces frequently took place. Now, owing to the careful manner in which the operation of excision is performed, this disaster very rarely occurs. The wound is thoroughly freed from tuberculous products by flushing, and is further protected by the application of strong carbolic acid, or a solution of biniodide of mercury—one part in a hundred of methylated spirit—to any portion of the wound of which the condition is suspicious.

The operation is best performed through an anterior incision, a method originally introduced by Professor Simon, of Heidelberg. In a case of suppuration of the hip-joint following a punctured wound, he enlarged the wound in a direction parallel with the femoral vessels. The case was published in 1866. Lücke's incision passed between the rectus and the psoas; while the incision employed by Hueter, and, at about the same time, by R. W. Parker, lies just internal to the tensor fasciæ femoris, and passes between this muscle and the sartorius and rectus. By this incision, which is well adapted for its purpose, neither any muscle nor other structure of importance is divided, and the joint is easily exposed. The capsule is freely opened and retracted; the neck of the femur is divided *in situ* with a fine saw or forceps, and the head removed; the acetabulum is examined and, if necessary, its floor is gouged away; great pains must be taken to remove all tuberculous synovial membrane, together with all granulation-tissue; a drainage-tube is inserted into the deepest part of the joint, and the external wound is closed around its outer end. The limb should be placed on a carefully fitted Thomas's splint. The different steps of the operation should be carried out with the

least possible injury to the parts concerned, so that these may be left in the most favourable condition for healing. The drainage-tube may sometimes be removed at the end of twenty-four hours, but in septic cases it may be advisable to retain it longer in order that the joint may be efficiently irrigated.

The knee.—In the middle and upper classes, in whom joint-disease is detected early, and adequately treated by rest, excision of the knee is scarcely ever performed. At present, however, there are many among the poor who can neither be adequately treated at home nor retained in a hospital for the necessary time, in whom tuberculosis, though it may never assume an acute form and may never lead to suppuration, is allowed to go on for months, or even for years together. In such cases the synovial membrane has passed into a condition of advanced “pulpy degeneration,” the ligaments have been softened and in great part destroyed, the cavity of the joint is obliterated by the formation of adhesions between the ends of the bones, and the tibia has undergone irremediable displacement towards the popliteal space. In these instances—which I will term group (a)—no treatment short of an operation can restore the limb to use. Here excision will yield the best attainable result, and when it is performed under safeguards against septic changes in the wound, it involves a scarcely appreciable danger to life, and sound repair may in most instances be anticipated. In this group of cases excision is an appropriate and serviceable operation.

In young subjects deformity is liable to follow excision, and very great care is required in the after-treatment until growth is complete. Fig. 49 illustrates a good result after excision at the age of 9. The radiogram was taken four and a half years after operation.

(b) Sometimes, added to the features just noticed, there is disease of the ends of the bones, attended with

chronic suppuration. In these cases excision will often be followed by firm union, though the process of repair will be tedious, owing to the fact that during the opera-



Fig. 49.—Firm union without deformity or shortening, four and a half years after excision of the knee, at the age of 9, for tuberculous disease of the joint involving the patella.

tion it is necessary to gouge away part of the bone, so that a cavity is left which is only slowly filled up.

(c) In acute and rapidly advancing cases, in which tuberculous disease has originated in the articular end of one of the bones and has thence extended to the joint itself, it is advisable to perform excision as a means of

averting amputation. The question, however, in such cases is whether, without trenching on the epiphyseal line, the infected structures can be completely removed. Unless this end can be secured, although the wound heals by primary union, disease may be renewed in the form of a tuberculous osteitis, attended with extension to the surrounding soft structures. But, even should this occur, if the patient's surroundings are favourable and rest is maintained, recovery may be, as I have seen on several occasions, ultimately secured.

The frequency with which surgeons resort to excision of the knee will depend on the object which they propose to secure. For my own part, I would say—and I am here subscribing to the opinion of the great majority of English authorities on the subject—that the cases in which the operation is mainly required are those where irremediable displacement has occurred. In other words, it is not so much the amount of disease, as the presence of deformity, which renders the excision advisable. In many cases, indeed, in which the disease has either already been cured, or is so limited that it would readily yield to treatment by rest, such deformity has occurred that the operation is still required in order that the limb may be placed in a position in which the patient can walk upon it. The age of the patient is a very important point in respect to excision of this joint. In children under six the operation is highly unadvisable, for in all but the worst cases disease may be cured by rest, and with the subsequent growth of the limb deformity, even though it is considerable, will gradually disappear.* At this early age the ends of the bones are still formed partly of cartilage, and, as firm union cannot be obtained, deformity is very likely to recur, and the growth of the limb, moreover, will probably be arrested. The best age for excision lies between fifteen and twenty-five, when

* "Clinical Essays and Lectures," p. 25, 1902.

the limb has attained the whole or the major part of its growth, and when the processes of repair are still active. In more advanced life the dangers attending the operation somewhat increase. Yet there are several conditions in adults, up to the age of forty-five, in which it is advisable to perform excision. These may be grouped as follows :—Cases of (*a*) advanced tuberculosis of the synovial membrane, limited disease of the ends of the bones, and no suppuration ; (*b*) ankylosis, with deformity, following tuberculosis, or some form of septic arthritis, e.g. after parturition ; (*c*) incomplete fibrous ankylosis after septic arthritis, rendering the joint painful and liable to increasing deformity ; (*d*) osteo-arthritis, in which a combination of pain and distortion renders the limb useless. Such cases must be carefully selected, but I have met with several instances in which the result was very good. The following example may be given :* A man, aged 44, who looked prematurely old, and all of whose fingers were crippled and deflected towards the ulnar side by osteo-arthritis of long standing, was able to walk only with great difficulty, as his knee had become fixed in a position approaching a right angle. There was lipping of the articular borders, with enlargement of the patella. Though the patient was poorly nourished, thin, and already grey, yet, as his internal organs were sound, he was advised to have the joint excised. At the operation the bones were found to be in a condition of fatty degeneration, so that they were soft and oily. The wound healed within eight days, and the patient left the hospital in seven weeks, firm synostosis having taken place, as in Fig. 49. He was seen two years later : the limb was then straight and serviceable.

The operation.—Of all the excisions, that of the knee is the most important as a surgical operation. The

* See “The Present Value of Excision of the Knee-Joint” (“Clinical Essays and Lectures,” p. 75).

wound is more extensive, and the bony surfaces exposed are larger than in any other case. Besides, this is the only instance in which it is a necessity that bony union should be secured.

The success of the operation is largely dependent on the form of splint employed. The main difficulty, especially when the bones of the leg are considerably displaced backwards, is to prevent the riding of the femur in front of the tibia. The plan of firmly bandaging the lower end of the femur to the back-splint leads to swelling about the wound. It is apt also to induce persistent venous oozing after the operation. To avoid these drawbacks I have found Mr. Gant's splint very satisfactory. It consists of two portions, one a simple back-splint (a little trough-shaped, and wider above than below, to correspond with the outline of the limb), extending from just below the tuberosity of the ischium nearly to the ankle. This is padded in its whole length; but extra padding is placed upon its lower half, where it corresponds with the tibia. By this means, instead of binding the femur down to the level of the tibia, the operator binds the tibia up to the level of the femur, so that no tight bandaging of the thigh is employed. The amount and disposition of the extra padding must, of course, vary with the case. When the limb has been accurately adjusted and secured on the back-splint with wide pieces of strapping, not too tightly drawn, and a bandage, the second part of the apparatus is applied. This is formed of an outside splint extending from the great trochanter to the foot. It is furnished with a foot-piece, and is interrupted at the knee so that the wound can be easily dressed. This outside splint has the effect of steadying the limb, and, acting with the back-splint, it maintains the bones accurately in position.

A proceeding which greatly assists in keeping the bones in apposition is that of pegging them together,

either with bone pegs, or, preferably, with stout steel pins as used by Mr. Baker at St. Bartholomew's Hospital. These are passed through the soft parts into

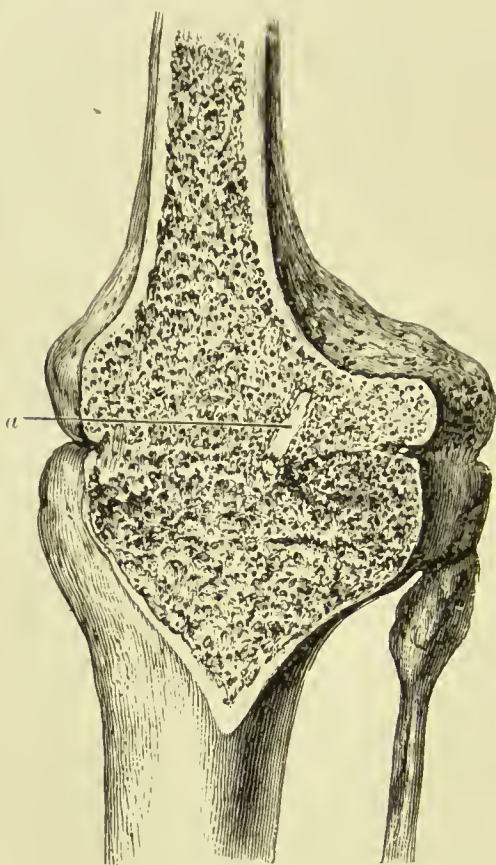


Fig. 50.—Vertical section through the bones of a knee-joint, showing true bony ankylosis after excision. One of the bone pegs, *a*, used for fixing the bones is seen still *in situ*.

(From a specimen, No. 657A, in St. Bartholomew's Hosp. Mus.)

the tibia, and on, for about an inch and a half, into the femur. The pins are removed (an easy matter, as their ends are left projecting) on the tenth to the twelfth day. I have used them for many years. I have never seen them do harm.

(Fig. 50.)

A modification of the usual operation, in the course of which the patella is removed, is the method by which the patella is sawn across at its middle, and its two portions are turned, the one up and the other down. When the operation is completed, they are replaced, and united by two stout catgut

sutures, which are passed through the substance of the bone after it has been drilled. In a case in which I adopted this plan, but in which a single stout silver-wire suture was used, a strong limb was obtained, upon

which, within six months of the operation, the patient, a boy of 15, was able to walk from London to Great Yarmouth, a distance of about 120 miles, in seven days, thus travelling seventeen miles a day. On examining the limb a month after this journey, I found it quite firm and free from any bend. This method may very well be adopted in cases in which the patella is free from disease, and in patients above the age of eight or ten. But when the patella is involved in disease, or when it is still in part cartilaginous, it will probably be best to remove it. It has been argued by some that by leaving the patella after removal of its cartilaginous surface, and fixing it to the condyles of the femur, the union is strengthened and the risk of subsequent flexion is diminished. Flexion-deformity in adults is the result either of an imperfectly performed operation or of subsequent imperfect fixation of the limb, and it very rarely results when due care has been practised. Fig. 44 (p. 290) shows a knee-joint in which fibrous union has occurred between the femur and tibia, and yet flexion has taken place, although the patella is united to the femur by bone.

Recurring deformity after excision of the knee.—It is not uncommon to see flexion-deformity after excision of the knee in young subjects. Inquiry will usually elicit the information that the knee was straight when the patient left the hospital, and only began to bend when the splint was left off, though sometimes, owing to imperfect splinting, this has occurred while the apparatus was in use. Encouragement is given to flexion in the practice of some surgeons, who fix the limb in a position of slight flexion on the assumption that it is more serviceable in that position. A slight amount of primary flexion may be seriously increased by the weight of the body and the action of the powerful hamstring muscles. In other

cases, if any diseased tissues are left behind, especially in the neighbourhood of the epiphyseal line, flexion or other deformity may readily occur. Occasionally, when the epiphyseal line in growing bones has been encroached



Fig. 51.—Genu valgum and shortening after excision in early life.

on at the time of operation, not only may shortening result, but the more serious deformity of either genu valgum or genu varum, from suppression of growth on one side or the other of the epiphyseal line, may occur. Figs. 51, 52, and 53 are examples of genu valgum and

genu varum resulting from excision followed by interference with growth in young subjects. Fig. 54 illustrates extensive flexion-deformity following excision in a young subject.



Fig. 52.—Genu varum after excision in early life.

The ankle.—Excision of the ankle, as a systematic operation, is very seldom required either for tuberculosis or any other disease. In the early stages of tuberculosis of this joint, treatment by local rest will very generally succeed. If advanced synovial disease is present, or if

suppuration has occurred, the best course will be to perform arthrectomy (p. 330), the astragalus being, if



Fig. 53.—Severe genu varum occurring after excision in early life.

necessary, removed. When as much as this is done, some may maintain that the operation practically amounts to excision. But, although such a proceeding is somewhat

more than arthrectomy, it is yet somewhat less than excision, for the articular ends of the tibia and fibula are preserved, and the internal lateral ligament is in great



Fig. 54.—Severe flexion-deformity after excision in early life. Translucent areas may be seen at the epiphyseal lines, which suggests that active disease is still present.

part left undivided. The few excisions of this joint which I have seen, when compared with such excellent results of arthrectomy as those which Mr. Clutton has

recorded,* have clearly shown the superiority of the latter proceeding. I shall not enter upon the details of excision of this joint, for I can add nothing to the directions for its performance which are to be found in the text-books.

* *Med. Chir. Trans.*, 1894, lxxvi. 85.

CHAPTER XXII

ARTHRECTOMY, OR ERASION OF JOINTS

THOSE who have watched the development of the operative treatment of tuberculosis of the joints during the last twenty years, and seen the conservative principle constantly assert itself, have felt assured that such a proceeding as excision—that is, the total sacrifice of one of the large joints—would not long be accepted as the routine treatment of tuberculous disease in young subjects. It was certain that strenuous efforts would be made to replace it by some less radical method: in other words, that as excision was introduced as a substitute for amputation, so it, in its turn, would give place to some procedure of a still more conservative nature. A step in this direction was taken when, in 1881, Mr. Cross, of Clifton, proposed the method which has since been termed by Wright, of Manchester, erosion, and by Volkmann, arthrectomy. This operation consists, in principle, of the systematic removal of all the synovial membrane and the ligaments, if, or so far as, they are involved in the disease—the bones, except when they are found to be superficially eroded, being left intact. Mr. Wright, so well known for his numerous and excellent contributions to the Surgery of Childhood, has taken a leading part in the development and practice of this operation. Originally applied to the knee, arthrectomy has in the last few years been adopted also for the elbow and ankle.

In arthrectomy of the **knee**, the joint is widely opened, as in excision; the patella is turned down, and

in advanced cases the lateral ligaments are divided. The whole of the synovial membrane is then systematically removed. This is best done by dissecting it away, as far as possible, as a continuous layer, with a scalpel and forceps. But scissors may also be freely used. If practicable, the crucial ligaments are saved, but in many cases it is impossible to remove the synovial membrane at the back of the joint until they have been cut. If the ends of the bones are found to be superficially eroded, they are freely scraped. Mr. Clutton remarks: "Whether a thin layer of cartilage is removed from the articular surfaces, and the bones made to ankylose by pinning or wiring them together, depends on the conditions found at the operation and the views of the operator. As a rule, on account of the knee being in the centre of a limb where the chief function is that of supporting the weight of the body, it is better to aim at immediate ankylosis than to have the knee slowly undergo a subsequent contraction. If the cartilages are left, such rapid fusion of the two bones cannot be obtained." Most surgeons would pronounce this view to be correct in theory. The practical difficulty, however, is that often no firm synostosis, but only fibrous ankylosis, can be obtained; while if it is desired to procure bony ankylosis, excision, it would seem, is the better proceeding, since it promises a much more certain result by bringing large and flat surfaces of the femur and tibia into contact.

In the **ankle**, the method which Mr. Clutton recommends, and which I have found convenient, is the following: Four incisions are made, one in front of, and one behind, each malleolus. These avoid ligaments and tendons, but secure a free ingress to the joint. Through these incisions, when their edges are well retracted, a sharp spoon can be introduced and the synovial membrane can be cleared away; while by

passing in the finger through the different openings the condition of the bones can be ascertained. Any diseased structure thus detected is then scraped out. Some surgeons, having opened the joint from the outer side, proceed as a matter of routine to remove the astragalus, in order to secure a better exposure. No doubt this method may leave a useful foot, but the operation is something more than arthrectomy, and approaches an excision. It seems unnecessary except in cases of extensive disease.

Arthrectomy, when applied to the **elbow**, is similar in principle, and need not be particularly described. In the case of the **hip**, only a modified or partial arthrectomy is practicable, for in order to reach all the synovial membrane the head of the femur must be removed, a proceeding which would amount to excision.

Selection of cases.—The cases in which arthrectomy is appropriate require very careful selection. The disease must be mainly limited to the soft structures of the joint. When the cancellous tissue of bones is materially involved, arthrectomy is out of place. The more limited the degree in which the synovial membrane is involved the more favourable the case, so far as the immediate result of the operation is concerned, and those who do the operation in early disease will be able to show the best results. In early cases, however, the operation is not required if rest and its accessories can be secured. A wide extent of synovial disease is not a bar to successful arthrectomy in such joints as the elbow and ankle, for although it necessitates free division of ligaments, and leaves movement much restricted, the parts are braced up by the development of new fibrous tissue, and the joint remains firm and serviceable. In the case of the knee, inasmuch as the lateral and cruceal ligaments may have to be divided in order to follow up and remove all the diseased synovial membrane,

the joint is so much weakened that there is an obstinate and prolonged tendency for the leg to become flexed upon the thigh.

When suppuration has occurred in a joint, the chances of a favourable result after arthrectomy are much diminished. They are still further reduced when the structures have become septic and sinuses have formed. By far the best results of arthrectomy that I am acquainted with were related by Mr. Clutton.* The series included nine cases of the elbow and six of the ankle. In the elbow, in two cases, ankylosis had occurred; six had more or less movement; the ninth was subsequently excised. Three cases of the ankle were excellent; in two of them the patients were walking without lameness and with some movement in their ankle and tarsal joints, and in one the patient was able to be on the limb thirteen hours a day as a hosier's assistant; in the fourth case the wounds were healed and the foot was free from disease; in the fifth no disease remained and the patient was walking on the limb, but there was some displacement; the remaining case was lost sight of. This is a record of success which, when the elbow and ankle are in question, shows that in selected cases the operation is a valuable addition to our resources of treatment.

In the hip, as already stated, in order to remove the synovial membrane from the inner surface of the capsule, and clear away the fatty tissue from the depression in the floor of the acetabulum, the head of the femur must be either removed or displaced. Besides—and this is a crucial point—tuberculous disease of the hip begins, as a very general rule, in the bones. On this ground alone arthrectomy for the hip would seem to be unsatisfactory. In regard to the knee, in the majority of cases great difficulty in obtaining good results has been

* *Trans. Med.-Chir. Soc.*, lxxvii. 85.

encountered. The source of difficulty is clear when the structure of the joint is considered. While the hip, the ankle, and the elbow owe their security to the modelling of their articular ends, in the knee this security is almost entirely dependent on the presence of powerful ligaments. These ligaments, while they connect the bones firmly together, yet allow flexion and extension, sliding and rotation, either singly or in constantly varying forms of combination. By arthrectomy not only is the largest of the synovial membranes completely removed, but the ligaments are divided. In fact, all the essential components of the joint, except the articular ends themselves, are sacrificed, and the bones are henceforth connected merely by cicatricial tissue. One is almost tempted to remark that if, after this, a useful joint remains, the original structures would appear to have been a needless elaboration.

These remarks are not intended as an adverse criticism of arthrectomy as matters at present stand. When, either from the ignorance of parents or from deficient hospital accommodation, a case has been allowed to advance so far that the synovial membrane of the joint has become the seat of extensive and chronic tuberculous disease, recovery without surgical interference is no more likely to occur than it is when lymphatic glands are occupied by old-standing tuberculous products. In both cases alike the best available course is to remove the structures, the repair of which has become hopeless. My object is, so far as this can yet be done, to arrive at the comparative value of arthrectomy as a resource in the treatment of tuberculous joints. And the conclusion, it appears to me, must be the same as that which is reached after a study of the principle, and a consideration of the results, of excision. No matter what the operation is termed, or whether the whole joint, including the articular ends, is removed, as in

excision ; or whether, while the other constituents are sacrificed, the articular ends are left, as in arthrectomy, the proceeding falls far below the level of conservative surgery, as it is practised in all other departments, except in the case of malignant disease. In malignant disease our only resource at present is entirely to remove the affected part. In other instances the object always is, while eradicating the disease, to preserve the organ which it has involved. We must be satisfied with nothing less than this in the case of tuberculous joints. A child who has had his hip or his knee excised or erased—no matter how safely or rapidly the wound may have healed—has lost one of his chief organs of locomotion. Such expedients, sound as they may be as successive stages in the evolution of surgery, are certain, having had their day, to give way, as amputation has done, to measures of a still more conservative kind. Such measures, of which a large experience has already been obtained, consist in the recognition of the disease while it is still in its incipient stage, and the immediate adoption and the persistent use of complete local rest, together with the provision of conditions favouring the general health, assisted possibly by tuberculin-injections.

CHAPTER XXIII

DISEASES OF THE TEMPORO-MAXILLARY JOINT

MANY diseases commonly met with in other joints are rare or unknown in the temporo-maxillary articulation ; yet there are several affections to which it is liable. The chief of these are : 1, osteo-arthritis ; 2, septic infection ; 3, tuberculous disease, which may extend to the joint either from the ear or from the ramus of the jaw ; 4, internal derangement or subluxation (displacement of the interarticular fibro-cartilage). It seems advisable also to allude (5) to a group of cases in which movement in this joint is prevented by spasm of the surrounding muscles, for I have met with several instances where the condition on which this closure of the jaw was dependent had escaped notice.

1. **Osteo-arthritis.**—The temporo-maxillary joint is so frequently the seat of osteo-arthritis that, together with the carpo-metacarpal joint of the thumb, which is also often attacked, it should always be carefully examined if indistinct symptoms in any of the other joints from which the patient is suffering are suspected to be due to this affection. If the case is one of osteo-arthritis, evidence to that effect may often be detected in this articulation. The disease presents here very similar features to those which are observed in the other joints. It usually occurs in persons over fifty, who are already suffering with the disease in other joints ; but it may occur in young subjects. Either the right or the left joint, or both, may be attacked. The symptoms are pain and cracking or creaking on movement,

stiffness, and some general fullness, or even, in rare cases, marked deformity. Robert Adams gives, in Plate I. of his Atlas, an illustrative case, in which considerable deformity and want of symmetry may be observed between the two lateral portions of the jaw. "The right condyle is greatly enlarged, the surface of the articular part is rough and scabrous, the inter-articular cartilage, as well as the cartilage of incrustation, has been removed. The height of the right ramus and its condyle inclusively exceeds by one inch the height of the same portion on the left side of the lower jaw. The right glenoid cavity is much increased beyond its usual size and capacity; . . . the maxillary eminence has not only been removed, but the temporal bone where it normally forms this eminence, and the root of the zygomatic process, have been excavated to receive the enlarged condyle." Drawings from the east of the face and from the macerated skull in this case show the "distorted appearance of the visage and protrusion of the chin to the left side, circumstances anatomically accounted for by the lengthened ramus and condyle of the jaw on the right side." In the later stages of the disease movement becomes more and more interfered with, so that the patient is able to open the mouth to only a very limited extent, and is unable to masticate food. In a well-marked case that came under my observation the disease had been produced by injury. The patient, a lady aged 54, fell and struck her chin upon the edge of a stair. This accident was followed by a persistent form of osteo-arthritis, involving the condyle and neck of the jaw, and leading to the same kind of absorption of bone that is met with in the head and neck of the femur after falls on the trochanter (p. 408). Both the joints became stiff, so that the patient, at the end of three months, could not separate the teeth for more than a quarter of an

inch; the teeth of the lower jaw receded considerably behind those of the upper, so that, as the patient said, she could no longer bite a piece of cotton, and the angles of the jaw became less prominent than they were before the injury. Fig. 55 illustrates the changes which occur in the glenoid cavity in an advanced case of osteo-arthritis.

Treatment is attended with very imperfect results. Patients often seek advice only when the disease has been slowly advancing for a period of several months, and when serious structural changes have already taken place; but even at its commencement the affection generally proves to be very obstinate. The remedies most likely to be useful are repeated small



Fig. 55. — Osteo-arthritis of the temporo-maxillary joint. The glenoid cavity is extensively eroded and hollowed out, and there is considerable overgrowth of bone at the articular margin.

(From a specimen, No. 664, in St. Bartholomew's Hosp. Mus.)

blisters, which here, as in the case of other joints, tend to relieve both the pain and the stiffness of osteo-arthritis; hot sponging; warm covering, so that the joint is protected from the sudden changes of temperature to which all the parts of the face are generally exposed; and passive movement, effected by the use of a screw-gag, whose blades, which should be covered with a thin plate of cork or indiarubber, are slowly separated when they have been introduced between the teeth. Very little force, however,

must be used. The practice of giving an anæsthetic and forcibly opening the mouth with a powerful gag has never, within my observation, been attended with any marked improvement. Usually it not only causes the patient considerable pain, but is followed, each time it is repeated, by an increase of stiffness.

2. Occasionally the temporo-maxillary joint is the seat of acute inflammation occurring during some form of **blood-poisoning**. I have seen it in pyæmia, and also twice as a sequel of scarlet fever in childhood, and in gonococcal infections. The *treatment* is the same as that which is required in other joints that are the seat of this form of arthritis. Pus should be evacuated at the earliest moment at which it can be detected. If it is allowed to collect in any quantity, it will not only burrow widely among the important structures in the neighbourhood, and perhaps lead to thrombosis of the adjacent veins, but may also give rise to meningitis by inducing necrosis of the thin plate of bone which forms the floor of the glenoid cavity at the base of the skull. Another direction in which pus may extend and produce serious mischief is towards the middle and internal ear, by making its way through the Glaserian fissure.

3. In cases of **tuberculous otitis** attended with suppuration, pus sometimes finds its way from the cavity of the tympanum through the Glaserian fissure into this joint; and in cases in which necrosis of the petrous portion of the temporal bone occurs, the articulation is sometimes entirely disorganised, and movement of the jaw on that side is to a great extent lost. The possibility of the occurrence of this result may well be added to the other urgent reasons that exist for the adequate treatment in its early stage of suppurative otitis. In two instances I have seen pus, formed in connection with tuberculous periostitis of the external

aspect of the ascending ramus of the jaw, make its way into the temporo-maxillary joint. In one of these a large collection of pus had formed, extending from the angle of the jaw to the zygoma. When this was opened the surface of the jaw was found to be bare, and a probe passed readily into the interior of the joint. The patient, a boy of 10, ultimately recovered, but the movement of the jaw on that side was much impaired.

4. **Subluxation.**—This condition is briefly described by Sir Astley Cooper.* It is met with most commonly in young adults, especially in young women, in consequence of relaxation of the ligaments, resulting from feeble nutrition. It may, however, as I have seen, occur in middle-aged or elderly patients, as the result of a lax condition of the ligamentous structures, such as is not rare in rheumatic subjects. I have related an instance of the affection at p. 278. The symptoms are sudden inability on the part of the patient entirely to close his mouth; some deviation of the jaw, so that the symphysis is carried a little over towards the opposite side, and the teeth do not correspond; there is also pain, which is sometimes severe. When the condition is of any duration a snap when the slip occurs is felt, and may often be heard even at some distance. In one case the condition followed a fall on the chin, which had apparently either separated the cartilage from its attachments, or torn it across, so that the condyle slipped in front of it and thrust it back towards the posterior part of the articulation. Reduction often immediately follows the slip, or can be at once effected by some movement of the jaw which the patient has learnt will replace the cartilage. In a case in which there was difficulty, so that a surgeon was consulted, reduction would be best effected by the methods that are employed in the reduction of dislocation of the jaw. It is very difficult to prevent

* "Dislocations and Fractures," p. 266, 10th ed., 1839.

the tendency to the recurrence of this accident. The patient should habitually guard himself against wide movements of the jaw. Small blisters may be applied over the joint. Sir Astley Cooper advised the shower-bath, but a hot douche would be preferable in young and anæmic subjects. Tonics, especially easily digested preparations of iron, should be prescribed if the general health is defective. In many of these cases treatment, though it may be to some extent beneficial, does not entirely cure the affection. The patient, however, finds that the slip becomes less painful, and he also learns how at once to "put his jaw in," so that the condition is not usually a source of very material trouble. In any case in which the functions of the jaw are very seriously interfered with, and in which all other treatment has failed, the cartilage should be fixed by suture, or, if its attachments are torn and its surface deformed, dissected out.

5. Closure of the jaw from spasm of the masseter and other muscles may depend on reflex irritation, arising either from difficult cutting of a wisdom-tooth, or from disease of one of the other molars. Sometimes it is due to cold. It is most often met with in young adults in connection with delayed eruption of a wisdom-tooth. Diagnosis is usually easy, for the evidences of dental irritation are readily detected. In these cases the jaws should be separated by means of a gag when the patient is under an anæsthetic, and the carious tooth, or the retained wisdom-tooth, as the case may be, should be removed. Sometimes the contracted state of the muscles and consequent closure of the jaw persist, even for several weeks, after the original irritation has subsided. In such instances movement may be restored by opening the jaw once or twice with a screw-gag.

Ankylosis of the temporo-maxillary joint.—Should ankylosis occur at the temporo-maxillary joint, an attempt must be made to restore movement by

operation. In 1854 the late Sir George Humphry successfully resected the condyle for ankylosis following rheumatoid arthritis. Other surgeons have performed resections through the ascending ramus, and also through the angle. Unfortunately ankylosis is prone to recur. In 1893, Helferich originated the method of introducing a flap of muscle between the surfaces of resected bone, to prevent re-ankylosis, by securing the formation of a

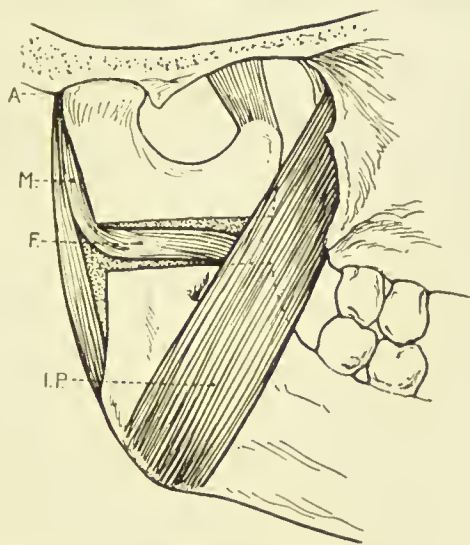


Fig. 56.—Resection of the ascending ramus of the mandible, with interposition of muscle, for ankylosis of the temporo-maxillary joint. (After Huguier.)

A, Ankylosed joint; M, masseter; F, flap of masseter; I.P, internal pterygoid.

serous bursa between the resected surfaces. Huguier* strongly recommends this procedure, and relates a number of successful cases. Fig. 56 represents a resection through the ascending ramus, seen from the inside. A portion of the masseter has been separated and sutured to the internal pterygoid. Huguier has practised this method in the case of other joints, notably the elbow, and his interesting monograph will repay perusal.

* Huguier, "Traitement des Ankyloses par la Résection Orthopédique et l'Interposition Museulaire" (Paris, 1905).

CHAPTER XXIV

DISEASE OF THE SACRO-ILIAC JOINT

TUBERCULOUS disease of this joint deserves careful study. In the first place, because it is often attended with very obscure symptoms, and may thus be confounded with disease of the spine, the hip, or other neighbouring parts; secondly, because it is very important that a correct diagnosis should be made early in the case, and that the necessary treatment should be applied without delay. Unless this is done, the prospect before the patient is that he will be confined to bed for months, or even for years, with an affection which is attended with much suffering and which shows but very little tendency to repair; or his disease may assume an active form, and lead to a fatal result by suppuration and exhaustion. Fortunately the disease is rare. It is very seldom met with in childhood. The large majority of cases diagnosed as disease of this joint are, in adults as well as in children, instances of tuberculous disease of the lower lumbar vertebræ. It is most often seen in patients between the ages of fifteen and thirty-five, though it may occur either before or after that period. Inflammation of this joint is for the most part tuberculous, but it is probably sometimes the result of injury in otherwise healthy subjects. In two cases it made its appearance soon after normal child-birth. It has also been met with in the course of septicæmia, and I have seen one instance in which it followed typhoid fever. No doubt it is occasionally produced by an extension of

disease from adjacent parts of the pelvis, or by the burrowing into the joint of pus from an iliac or psoas abscess.

The disease may commence in either of the bones forming the joint, or in the tissue which intervenes between them. Owing to the peculiar relationship of the bones (there being no true synovial cavity) and to the depth at which the joint is situated, and to its protection by the strong and thick posterior sacro-iliac ligaments, diagnosis is often not made until suppuration has occurred and the joint has become disorganised. In its usual form the disease is chronic, and the process of inflammation is inactive, tedious and slow (caries sicca); but sometimes it is from the first acute, and soon passes on to suppuration, the destruction of the joint, and the death of the patient by exhaustion. In some cases it becomes complicated with acute tuberculous phthisis. In acute or far-advanced cases the bones are carious, the cartilage has disappeared, the ligaments have been destroyed by ulceration, and the joint admits of abnormally free movement. When suppuration occurs, pus may (1) track backwards and present over the joint or in the lumbar region; (2) burrow forwards into the iliac fossa, and thence through the sacro-sciatic notch, and so form a subgluteal abscess; (3) follow the curve of the sacrum and present in the ischio-rectal fossa, or (4) pass into the iliacus or psoas, and so make its way to the groin or thigh. In instances in which recovery takes place, repair is effected by the development of fibrous, or sometimes of bony ankylosis.

The **symptoms** of this disease are very variable, and so many of them are also the symptoms of disease in neighbouring parts, that a correct diagnosis is to be arrived at, not by regarding any particular symptoms as characteristic and always trustworthy as conclusive evidence, but by carefully weighing all the signs of

disease that are present, and by seeing whether disease of adjacent parts, especially of the lumbar spine and the hip-joint, can be excluded. This is always a main point in the study of these cases. It is well also to bear in mind that mischief is much more frequent in the spine and in the hip than it is in this joint, so that, *prima facie*, the probability is against the presence of sacro-iliac disease. The symptoms from the observation of which a correct diagnosis may be formed are the following:—

(a) *Lameness*.—The patient limps and assumes a “shuffling” gait, and often complains of a sense of insecurity about his hip and of a want of power, especially when he is going upstairs, or when he attempts to move quickly, stoop, or carry a weight. One of the earliest signs to appear is a “listing” of the trunk towards the unaffected side, a shifting of weight to the sound side, which as the disease advances results in a latera curvature of the spine with a dorsal convexity to the unaffected side (Plate 6).

(b) *Pain* is usually well marked, and is often severe. In some cases, however, it takes the form merely of a sense of uneasiness and wearing discomfort about the limb. It is felt over the joint itself, where there may be also marked tenderness on pressure; vaguely about the hip; in the back of the limb; or, more rarely, in the course of the cutaneous branches of the anterior crural nerve. In some cases pain is complained of only, or chiefly, at the knee, when it is apt, with other symptoms, to suggest the idea that the mischief is in the hip-joint. In acute cases pain is increased by coughing or sneezing, and particularly by a sudden jar of the limb as by a false step.

(c) *Tenderness* on pressure over the joint is a symptom to which great weight may be attached. It is not, however, always present.



PLATE 6.—SCOLIOSIS IN ASSOCIATION WITH
SACRO-ILIAC DISEASE.

A scar is seen over the right sacro-iliac joint.

(d) *Swelling*.—This is sometimes, especially if the patient is stout, quite inappreciable, but often some fullness and alteration of outline can be detected posteriorly on the suspected as compared with the opposite side. In the later stages of the disease, when suppuration has occurred, both swelling and fluctuation, or at least a sense of deep-seated elasticity, may be detected, either posteriorly or in the iliac fossa.

(e) *Alteration in the position of the limb*.—The thigh usually remains fully extended on the trunk. Often there is no change in the apparent length of the limb, the two malleoli remaining exactly level with each other. Neither is there any eversion. In other cases, however, there is half an inch, or even more, of apparent lengthening, depending on abduction (p. 422), and more or less eversion is present, with flexion due to contraction of the ilio-psoas.

(f) There is always *muscular wasting* of the gluteal region and of the rest of the limb; indeed, when the disease is established, the limb is usually to a marked extent wasted and powerless.

In investigating a case of suspected sacro-iliac disease, it must be remembered that lameness is of no diagnostic value. It is a symptom here, as in a case in which hip-disease is suspected, which shows that something is wrong, but it is entirely wanting in any specific character. Pain is in itself useless for diagnosis until we come to observe by what disturbance it is produced. It becomes strongly suggestive of sacro-iliac disease when it is provoked by pressing the crests of the two iliac bones either apart from each other, or towards each other, so as to put the ligaments of the articulation on the stretch, or to press the joint-surfaces into firm contact; especially is this the case if movement of the hip is painless and free, and if no evidence of disease of the lumbar spine can be detected. The presence of tender-

ness on pressure over the sacro-iliac joint is a symptom of much importance. Swelling, if taken alone, is deceptive. It may, as already said, be entirely absent; while any that is present may be due to an abscess burrowing beneath the glutei from disease of the spine. Swelling in the iliac fossa must not be overlooked. The posture of the limb cannot be in the least depended upon. It is sometimes, as already mentioned, quite unchanged; in other cases there is some apparent lengthening; or, when abscess is forming in the iliac fossa, there may be flexion and eversion combined with abduction, so that the position of the limb suggests hip-disease. A rectal examination should never be omitted, and often gives valuable information.

Having observed all these points, the surgeon should carefully investigate the condition of the lumbar spine and the hip-joint. The diagnosis of hip-disease is given at p. 417 *et seq.* Disease of the lumbar spine may be excluded if the column is found free from all suspicion of deformity; if no fullness or increased resistance can be detected in the vertebral grooves on either side of the spinous processes; and if the lumbar spine is observed to be freely movable. The diagnosis may often be confirmed by means of the X-rays, especially by comparison with the opposite side.

Treatment.—This must consist in the maintenance of long-continued rest in the horizontal position. In other words, it is the same as that which is demanded in disease of the lumbar spine. If diagnosis is made early, and rest is at once secured, the disease will undoubtedly in a considerable proportion of the cases subside, and recovery will ensue. Rest must, however, be persevered in for from six months to a year or more. An accessory means is repeated blistering, or the use of the actual cautery over the joint. I have seen the latter remedy very beneficial in relieving pain and arresting

the course of the disease. After the blistering or the use of the cautery, the pelvis may with advantage be enclosed in a well-fitted and well-padded leather or felt case fastening with straps and buckles. Pain is often at once relieved by this appliance. In a patient, aged 34, in St. Bartholomew's Hospital, with advanced sacro-iliac disease and suppuration, attended with some pain, weight-extension gave very decided relief, probably by steadying the pelvis and keeping the parts at rest. Should pus be detected, it ought at once to be evacuated, great care being taken to maintain asepsis. In early stages, when suppuration has arisen with but little caries, the wound may be closed, as in cases of psoas abscess, to avoid risk of secondary infection. A re-accumulation can always be dealt with by a subsequent operation. When caries of the bones has taken place, the disease has entered on a very intractable stage. With rest and free drainage, recovery may still ensue, but the probability is against this; nor can any operative treatment be depended upon to do material good. Generally, although the surgeon is induced to operate repeatedly, and although on each occasion he removes carious fragments, he may fail to secure repair. In cases, however, in which disease is confined to the structures of the joint itself, the removal of the affected tissues by scraping them away with a Volkmann's spoon, together with the free laying-open of all the sinuses that are within reach, may be followed by sound healing. A case of this kind was seen in St. Bartholomew's Hospital. The patient was a woman, aged 32, in whom several fistulous passages opening on the surface and leading into the sacro-iliac joint were laid open. The investing cartilage was in a condition of pulpy thickening, and was bathed in curdy pus. All the granulation-tissue was scraped away, so far as it could be reached, and the joint sponged out with a solution of chloride

of zinc, forty grains to the ounce. Complete repair occurred, and in the course of four months the patient was discharged with all the wounds closed. There was no recurrence, and some years later she was in full work as a domestic servant.

Mr. Golding Bird has described three cases in which he operated in the early stage of sacro-iliae disease, in patients aged respectively 14, 30, and 39. The wound healed in each instance by primary union. When the paper was read,* one patient was still under observation, but was doing well; the other two were up and walking about, without pain, and were to all appearances cured. In all the cases the symptoms, which had lasted many months, were lameness, pain, and well-marked tenderness on deep pressure over the posterior aspect of the joint.

The operation.—A semicircular flap of skin and subcutaneous tissue over the area of the joint, having its convex margin corresponding to the posterior edge of the ilium, is dissected up and thrown outwards, and the underlying glutei are similarly detached. The bone being thus freely exposed, a large trephine is applied at the root of the posterior inferior iliac spine, and in a line drawn from the tip of the spine to the junction of the anterior with the middle third of the iliac crest. This line lies in the axis of the articular surface of the joint.

At the root of the posterior inferior spinous process the bone is very thick, but the disc of bone removed should extend down to the joint. This opening enables an inspection of the joint to be made, if this is all that is desired; but to remove disease it must be further enlarged by whatever means the surgeon thinks best. It is essential that the amount of bone removed should be practically that forming the iliac surface of the joint.

When all visible disease has been removed, and

* *Lancet*, 1895, i. 1117.

especially if the trephine opening does not quite cover the area of the joint, the ilium should be prised off the sacrum with an elevator. Sufficient separation of the two bones is thus easily effected to allow of the introduction of a Volkmann's spoon, for the more effectual removal of disease or débris. A further gain from this manœuvre is that it may be the means of revealing pus lying just outside the limits of the joint, and not before known to exist. The pus wells up into the joint as the ilium is lifted up, and further opening may be necessary to get at and cleanse the cavity in which it lies. If the case is complicated with sinuses, these must be treated on general surgical rules; but Mr. Golding Bird expresses the opinion that the following up of a sinus as an indication of the route by which to reach the joint, with a view to exsision, is useless. The excision must be deliberately carried out in the way described, and then the sinuses dealt with.

When the patient is allowed up, he should be fitted with a Thomas's hip-splint and not be allowed to bear any weight on the limb until it is certain that sound healing has occurred in the joint, and that no evidence of disease remains.

In a lady of 62 I laid open a sinus extending from the gluteal fold into the sacro-iliac joint, and removed a flat sequestrum an inch and a half long and three-quarters of an inch wide. The wound healed in six weeks and full recovery followed.

CHAPTER XXV

DISEASES OF THE WRIST

IN children and young adults, **tuberculous disease** is often met with in this joint. Here, as elsewhere, the affection is apt to be so insidious that, in the majority of cases, it has made considerable advance before its presence is even suspected. Probably, for one case in which the affection is detected and adequately treated in the first month of its existence, there are twenty in which it is allowed to drift on for three or four months, or even longer, before it is recognised. While this is allowed, tuberculous disease of the wrist, as of the other joints, will maintain its reputation as an intractable condition, apt to lead to serious impairment of the limb. On the other hand, when an early diagnosis is made, and efficient treatment employed, these cases, as a very general rule, will end, in periods varying from six to twelve months, in absolute recovery. In many instances tuberculous disease of the wrist (as well as of other joints) ensues quickly after injury. But, as injury is the original condition, and as tuberculous inflammation is developed very insidiously, *the transition from the mere traumatic to the tuberculous type of inflammation is so gradual that it is apt to be overlooked*; and I have seen several instances in which, though tuberculous disease was obviously present, those who had been watching the case from day to day, as one of traumatic inflammation, had not been struck with the change that had supervened.

Symptoms.—The wrist is often a little dropped, so

that the hand forms an angle of about 120° to 140° with the forearm. Swelling is invariably present, so that, as compared with the opposite wrist, the various depressions between the tendons are obscured or lost, and not only is the wrist increased in size on measurement, but it exhibits a fullness and smoothness of outline, on both the palmar and dorsal aspects, which, even when it is slight, is very characteristic. This, together with muscular wasting of the forearm, has always seemed to me to afford the earliest and most suggestive evidence of disease. Indeed, it is often obvious before any other symptom has become well marked. Pain cannot be relied on. It is often very slight or entirely absent, not only at first, but for all the earlier period of disease. Movement, when tested by the surgeon, is frequently scarcely interfered with; though, if the point is looked to, it will be found that there is distinct, though slight, restriction of full extension and also of full supination and pronation. This limitation of movement is often earliest disclosed by the manner in which the patient uses the limb. He may be observed to have, as his parents think, a trick of putting his hand in some peculiar position in feeding himself, or in other common movements—the true explanation of which is that he cannot bend his wrist freely. Muscular wasting, as already indicated, is a symptom to which considerable weight must be attached. It should be looked for in the muscles of the forearm, where it is shown either by loss of girth of the limb, or by flabbiness and softness. Increased surface-temperature may be present over the dorsal aspect of the carpus, but this is frequently absent in the early period of the affection.

Treatment.—The forearm and hand should be without delay enclosed in leather splints (Fig. 57) and the arm kept in a sling. The splints should be removed twice a week for attention to the skin, and for passive move-

ment of the fingers, and massage of the forearm, so performed that there is no disturbance of the joint. Unless, however, these accessories can be employed by a fully-trained worker, it will be safer to withhold them and trust entirely to uninterrupted rest. It is important to remember that the power of grasping with the hand is increased when the wrist is extended. This should be borne in mind when applying leather splints for disease of the wrist. If the extensors are allowed to become relaxed and stretched, then the flexion power is greatly diminished; so that it becomes important to fix the wrist in the extended position to obtain subsequently the maximum power of flexion. Under this plan, and when means are taken to improve the general health, disease of the wrist will steadily recede. Any active symptoms that may have been present, such as pain, heat, and puffy swelling, will subside, and in six or eight weeks it will be obvious that the case is making satisfactory progress. The time during which treatment must be continued will, of course, vary. It should, however, I believe in no case be less than six months. The best rule is to persevere with the use of the splints for at least three months after all symptoms, including swelling, have completely disappeared; and to be ready rather to extend than to curtail the period of rest. I have often been struck with the effect of complete rest in the case of the wrist. Perhaps rest is here so efficacious because the splints are able to render it absolute. I have seen several instances in young adults in whom, although the patient was the subject of advancing phthisis, the joint-affection has undergone complete repair. Should pus accumulate (but this is very rare, unless the disease is already far advanced before the splints are put on), it should be at once evacuated aseptically, the splints being cut away so that dressings can be applied. In neglected cases, in which

extensive pulpy degeneration has been followed by caries of the carpal bones, suppuration, and the formation of sinuses, improvement will at once follow the institution of rest, and a useful joint will at length be obtained. Many of these instances, however, extend over from nine to twelve months.

The questions of excision and arthrectomy are discussed at pp. 314 and 331. I will only say here that even the best results that I have seen have made me believe that every possible means should be taken to escape the necessity of resorting to an operation involving more than the scraping away of granulation-tissue and the removal of any of the carpal bones that have become loose sequestra.

Osteo-arthritis is prone to affect the wrist-joint; but this usually in combination with like disease in many other articulations. The joint becomes stiff and notably weak. The patient is unable to lift an object of any weight. The wrist is also painful, especially on movement in certain directions, particularly if this is sudden; and the patient often finds that he is thus in danger of dropping whatever he has in his hand. Pronation and supination become limited sooner than flexion and extension, and cracking or creaking can frequently be felt. Swelling is often present in the form of puffy enlargement, especially noticeable on the dorsal aspect of the joint. In some cases the synovial membrane becomes distended into pouches and ganglionic enlargements, prominent on the dorsal aspect, and extending for some distance up the forearm, so that the disease thus far resembles ganglionic swelling of the sheaths of the tendons. The fact that these collections are often in direct communication with the carpal joints must not be overlooked when the question of evacuating their contents is being considered (p. 328). Usually it is best to abstain from all active interference with them,

Osteo-arthritis of the wrist is generally intractable. The best *treatment* consists in moderate exercise, warmth, hot-douching, hot-air baths, and blistering if pain is present. If pain is severe, and increased by exercise, the joint should be kept for the time at rest by a splint (Fig. 57).

Gonorrhœal arthritis is occasionally met with. In slight cases recovery may follow; but in the more severe forms a cautious prognosis must be given, as firm fibrous ankylosis is prone to occur. I have notes of the case of a man of 24, in whom, after an attack of acute inflammation following gonorrhœa, the wrist was left perfectly stiff, and flexed at an angle of about 130° . The muscles of the forearm were much wasted. Ether having been given, the joint was manipulated,

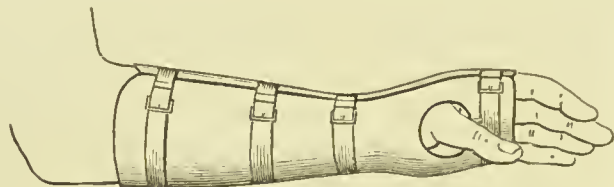


Fig. 57.—Leather splints for the treatment of disease of the wrist-joint.

so that it could be placed in a position of extension on a splint. It was subsequently treated by massage, and passive movements were sedulously practised. Posture was improved, and some motion was regained, so that the patient could write, but this was all that I could succeed in doing.

Rheumatic arthritis.—In cases of subacute but persistent rheumatic inflammation of the wrist, the ligaments sometimes become softened and relaxed, so that, as the result of this condition and of effusion, the joint tends to undergo formidable displacement, the carpus and hand together sliding towards the palmar aspect and the radial border of the limb. In such instances

no time should be lost in applying leather splints (Fig. 57). These will not only prevent or arrest a distortion which, if allowed to advance, would go far to cripple the limb; but they will tend to check the disease and promote a satisfactory recovery. Besides, they will be of great service in the relief of pain (p. 163).

Arthritis in the course of **septicæmia** is occasionally met with. It must be treated by rest, evacuation of matter, and drainage (p. 137).

Charcot's disease and **syphilitic disease**, especially the latter, are rare. They are, however, sometimes met with. (*See* pp. 208 and 79.)

CHAPTER XXVI

DISEASES OF THE ELBOW

THE elbow is very subject to disease. It may not only be attacked by tuberculosis, arthritis deformans, Charcot's disease, and syphilis, but is often the seat of traumatic inflammation more or less severe. Acute arthritis is often met with in septicæmia, and occasionally after scarlet fever and typhoid.

The *symptoms* of inflammation of the elbow-joint (to offer a general description of them) are these : 1. Swelling, seen chiefly on the outer side, in the neighbourhood of the head of the radius, and posteriorly on either side of the olecranon, so that the joint viewed from behind presents an appearance of increased width and fullness. There is also a longitudinal depression corresponding to the position of the triceps, with a puffy or elastic fullness on either side of the insertion of this muscle. When enlargement is considerable, the joint is maintained at an angle of about 140° (the position of greatest ease), and has a fusiform or globular outline. 2. Movement is in some instances much restricted or entirely lost, but in many it is only slightly impaired ; so slightly, indeed, that disease may easily be overlooked. Defect of movement is most apparent in the fact that the joint cannot be completely extended. In many cases of subacute inflammation, pronation and supination are scarcely at all interfered with. 3. Pain is very variable ; when disease is acute it may be severe, but in subacute cases pain may be deceptively trivial. 4. Heat is readily detected (so large a part of the joint being subcutaneous)

when inflammation is acute, but in mild cases it may be scarcely appreciable. 5. Muscular wasting of the upper arm quickly takes place, and often, in obscure cases, constitutes a valuable evidence of disease. It may almost invariably be detected when inflammation has existed for a fortnight or three weeks and upwards. I have found it distinct in acute disease within ten days. The total absence of muscular wasting in a case of suspected disease of the elbow-joint may be taken as strongly suggesting that the joint itself is not affected.

The *treatment* must be adapted to each case. In acute inflammation the joint should be at once placed on a splint. The joint may be covered with an evaporating lotion, or irrigated with iced water allowed to fall, drop by drop, on lint from a vessel suspended an inch or so above the part. In cases of punctured wound, or pyæmic infection followed by acute arthritis, should suppuration occur—an event that will be indicated by a continuance of severe pain and high temperature, combined with an increase of swelling, or the development of redness and œdema of the integument, so that the surface pits on pressure—a free incision should be made on the outer aspect of the joint, the synovial cavity should be freely irrigated, a small and short drainage-tube introduced, and the wound dressed antiseptically. In favourable cases, especially in the young, recovery will take place without loss of movement; but as the joint may become stiff, it should, during repair, be placed at an angle of about 100° . When simple synovitis has been acute and has extended over only a few days, should the elbow remain stiff at the end of six weeks after all inflammation has subsided, a cautious attempt may be made to restore motion under an anæsthetic; but when disease has been prolonged, and extensive structural changes have occurred, this practice will generally be either useless or mischievous.

Tuberculous disease.—This is very common, and most frequently sets in between the ages of three and nine. But it may occur at any period of childhood or adult life. More rarely it is met with in the old. (*See Senile Tuberculosis, p. 66.*)

Symptoms.—The joint, maintained at an angle of about 140° , becomes more or less stiff. Sometimes stiffness is very slight, and the joint will admit of all its movements except full extension—pronation, supination, and flexion remaining free. Usually, however, stiffness is much more marked. There is swelling in the form of fullness or puffy thickening, most apparent posteriorly on either side of the insertion of the triceps, so that the joint, looked at from behind, presents an aspect, as compared with its fellow, of increased width. In advanced cases the whole joint is enlarged and fusiform, and all the bony landmarks are obscured. Pain is often entirely absent, and is not provoked even by gentle movement. This absence of pain often induces parents, and perhaps even surgeons, to believe that no disease is present. Abnormal heat of the surface may be noticed, but its absence must not be taken as a sign that the joint is not affected. Muscular wasting can almost invariably be detected, especially in the upper arm. Indeed, muscular wasting, persistent swelling, and stiffness are the three symptoms that are most constantly developed.

Treatment.—At the earliest moment at which disease is detected the joint should be enclosed in a pair of well-fitting rectangular leather splints (Fig. 58),* and supported in a sling. These splints should be worn by night as well as by day. They should be removed only every second or third day—in order that the skin may be

* These and several other splints illustrated in this work are manufactured by Messrs. Spratt and Brooks, Brook Street, Hanover Square, London.

sponged, dried, and dusted with fine borie-acid powder—and then be at once replaced. I believe it is best not to use any local applications to the joint beneath the splints, for they lead to an undesirable amount of disturbance of the articulation without doing any material good. If the complete rest secured by the splints is continued for from six to twelve months, recovery will in a very large proportion of cases be obtained. Usually at least six months will be required. I have seen a considerable number of instances in which, after six months' rest, perfect movement has been regained, and no return of disease has subsequently been observed. When, as so frequently is the case, disease has been allowed to ad-

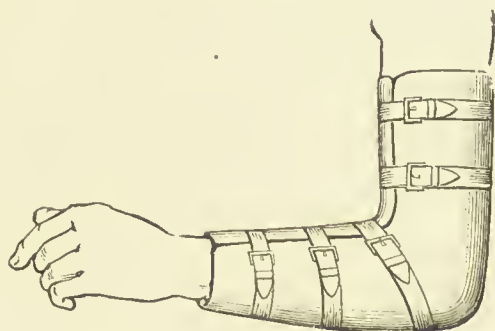


Fig. 53.—Leather splints for the elbow-joint.

vance for from three to six months or longer, a proportionately extended period of rest will be required. This may amount to a year or even eighteen months; but if this term can be secured a good result will ensue. Sometimes the joint will be stiff (*see* p. 55); but in many instances, although the splints have been uninterruptedly worn for as long as a year for the treatment of disease of long standing, free movement has been preserved. The splints should be worn for at least three months after all pain, heat, and swelling have disappeared; and movement should be only very gradually resumed. Should suppuration occur, the pus must be at once aseptically evacuated. If the disease has reached an advanced stage, and if sinuses have already formed, when the case is originally seen, the

joint should be placed at rest in leather splints, with openings large enough to make dressing convenient. Cases thus treated are often seen to undergo rapid improvement, so that in a few months the sinuses have healed. In many instances, however, the sinuses should be scraped and the synovial membrane removed, either by scraping, which will often suffice, or by a planned arthrectomy; while if the ends of the bones are extensively involved, excision will be the proper operation. The result of arthrectomy is often satisfactory, and the same may be said of excision, for an arm almost as useful as its fellow is secured. But in some cases, in young children in whom disease is very advanced, the surrounding muscles have undergone such extensive atrophy, that the limb is very weak and the joint is loose and flail-like for a considerable time.

Osteo-arthritis and **Charcot's disease** are both met with in the elbow. Neither, however, calls for detailed description, for the characters they present are very similar to those observed in such joints as the knee and the shoulder (p. 204 *et seq.*).

I have met with four instances of **hæmophilia** involving the elbow. In all, at a time when hæmorrhage was taking place elsewhere, the joint was observed to become suddenly swollen and painful. Enlargement continued for about a fortnight, and then gradually subsided. In two of the cases the joint was left much stiffened, and to some extent distorted, in consequence of changes apparently closely resembling those observed in osteo-arthritis.

Syphilitic disease.—Cases of syphilitic disease of this joint, in the form either of synovitis with effusion, or of gummatous infiltration of the subsynovial tissue, are by no means rare, and are often mistaken for tubercle. In two children, a boy of 9 and a girl of 11, both elbow-joints were the seat of effusion, and of con-

siderable thickening of the synovial membrane. Both patients had interstitial keratitis. Under the use of grey powder, and strapping with unguentum hydrargyri, the thickening and effusion slowly disappeared and the joints returned to a normal condition. The treatment, however, extended in the one case over three months, and in the other over five.

Cases in which, without presenting symptoms of still existing disease, the elbow-joint is found to be stiff, are not uncommon. The **stiffness** may depend either on adhesions outside the joint, following fracture, dislocation, or other injury, or result from slight synovitis, either traumatic or due to rheumatism of the joint itself; or it may originate in childhood from fracture in the neighbourhood of the joint, or partial detachment of some of the epiphyseal processes. In such instances the history of the case should be carefully ascertained, and if the injury or disease, of which an account is forthcoming, has been trivial, and if tuberculous inflammation can be excluded, an anæsthetic should be given, and a cautious attempt made to restore movement. This, if properly carried out, can do no harm, and it will sometimes prove completely successful. These are some of the cases in which an opening is too often left for the successful employment of so-called bone-setting by irregular practitioners (p. 527 *et seq.*).

CHAPTER XXVII.

DISEASES OF THE SHOULDER

Synovitis.—Simple synovitis, such as is sometimes met with in the elbow and knee, from overwork or injury, is very rare in this joint. Synovitis occurs, however, in acute rheumatism, or may follow typhoid or scarlet fever. The *symptoms*, which will vary to some extent with the nature and grade—as to acuteness—of the inflammatory process, are: (a) Stiffness of the joint, so that the humerus and scapula move together; i.e. when the elbow is carried forwards and backwards, or is drawn away from the side, the inferior angle of the scapula travels with it. (b) Swelling, taking the form of general fullness about the joint, and giving it a globular outline. Swelling is usually limited in tuberculous synovitis; but it may be very considerable, and attended with obvious fluctuation, both in acute rheumatism and in the various forms of infective arthritis; often the joint looks more enlarged than it really is, owing to wasting of the muscles of the scapula and upper arm. (c) Abnormal heat of the surface may be detected in the more acute forms of inflammation; but in many cases, owing to the thickness of the soft parts over the articulation, this symptom is not present. (d) Muscular wasting.

Treatment must be general and local. The arm must be kept at rest by the side of the trunk, and the forearm supported in a sling. General treatment should be directed to the condition out of which the joint-affection has arisen, whatever this may be; for a descrip-

tion of it, works on general medicine and surgery may be consulted. In *acute rheumatic* synovitis the joint should be wrapped in cotton-wool, and kept at rest at the side. Warm lead-and-opium lotion, or belladonna liniment soaked in lint and covered with oil-silk, may be applied beneath the cotton-wool. Sometimes relief is speedily obtained by painting the skin, over an area of two square inches, with blistering fluid. Aspiration of the joint, to relieve tension, is seldom called for, unless the effusion is excessive. Generally, when inflammation has subsided, movement is either spontaneously regained or may be restored by manipulative treatment (p. 534 *et seq.*). Synovitis occurring in the early stage of scarlet fever soon subsides, and requires no special treatment. Synovitis following *typhoid fever* is rarely met with in this articulation. The affection is either plastic, so that it leaves the joint fixed; or it leads to serous effusion, which is apt to induce spontaneous dislocation. This accident must be carefully guarded against. It can scarcely occur if the arm is kept at the side.

Tuberculous disease.—Tuberculous disease of the shoulder is common in children and young adults. It is usually very insidious and chronic, and sometimes makes considerable progress before it is detected. It may begin either as a synovitis (the most usual form) or as an inflammation of the shaft of the humerus just beneath the epiphysis, soon extending into the joint itself. In the latter form the head of the bone is sometimes reduced to little more than a shell. In two cases that I have seen, the head, reduced to a carious fragment, was found to have become separated as a sequestrum.

Symptoms.—Pain here, as in so many other instances of tuberculous joint-disease, is often completely absent, or so slight as to be mistaken for “growing pains.” When present it may be felt either in the joint itself, or

at the middle of the arm near the insertion of the deltoid. The most prominent symptoms are wasting of the deltoid and the scapular muscles, and stiffness of the joint, the inferior angle of the scapula being found to travel with the humerus whenever an attempt is made to rotate the latter in the glenoid cavity, or when the elbow is moved forwards or backwards, or is brought away from the side. In the synovial form of disease suppuration is rare; but when the humerus is involved an abscess may be developed, and may either give rise to a large fluctuating swelling beneath the deltoid, or may point at the anterior or the posterior edge of this muscle, or in the axilla.

The shoulder-joint is so easily kept at rest—its movements being readily performed either between the scapula and the thorax, or at the elbow—that, though disease is tedious, the destructive changes and suppuration often seen in other joints are seldom met with here, and recovery usually takes place. The joint, however, will probably be stiff.

Treatment consists in maintaining rest by keeping the arm bandaged to the side, and protecting the joint by moulding a leather shield-splint to the shoulder and upper part of the arm. These means should, even although disease is only incipient, be continued for from three to six months. In the rare event of the joint being painful, notwithstanding that it has been placed at rest, two or three small blisters, one healing before the next is put on, may be used; or, better still, the benzoline cautery may be lightly applied when the patient is under an anæsthetic. Should suppuration occur, the pus must be at once evacuated. In disease of the upper end of the humerus, the inflammatory process may lead to advanced rarefying osteitis, and the interior of the bone may be extensively broken down. Generally, owing to the soft and cancellous nature of the

tissue, no firm sequestra, requiring removal, are produced. Any fragments that are separated are readily disintegrated and got rid of in the discharge. No operation for dead bone, therefore, is usually called for; and the parts had better be left for repair under the influence of rest. Should a sinus, however, remain unhealed, in spite of rest of the joint continued for two or three months, it should be explored; if a sequestrum is found it should be gently extracted, and the granulation-tissue should be removed.

I have several times seen attempts made to restore movement in this joint in cases in which it had become impaired as the result of tuberculous disease. These attempts have been attended with failure, and in some of them a renewal of disease has been provoked.

*Y. case
one case
at early
stage*

Acute arthritis of infants (p. 26) is prone to attack this joint in the first few months of life. In the early stage the patient is observed to keep the arm still, and to cry when the limb is disturbed. In the course of two or three days the cavity of the articulation becomes distended with a collection of pus, forming a large globular swelling beneath the deltoid. The skin is generally free from inflammation, but assumes a congested and dusky appearance. As large subcutaneous veins become visible, the condition may, as I have more than once seen, be mistaken for malignant disease. If pus is evacuated early, good repair may follow; but in some instances the upper end of the humerus is rapidly destroyed, and the arm is left in a flail-like condition.

Osteo - arthritis.—Among the large joints the shoulder is, next to the knee and hip, the articulation most often involved. The affection generally commences after the age of forty-five or fifty, and is usually associated with similar disease in other joints. It begins with pain about the joint, or with a more persistent, dull, aching, or wearing sensation about the outer

aspect of the arm near the insertion of the deltoid. This is accompanied by a feeling of weakness, and by stiffness, especially after rest. All these symptoms increase, often very slowly, and are associated with muscular wasting, which may become very marked, and with creaking, cracking, or grating of the joint. By degrees the movements of the arm become more and



Fig. 59.—Osteo-arthritis of the shoulder-joint.

(From a specimen, No. 669, in St. Bartholomew's Hosp. Mus.)

more restricted, and any attempt at motion is painful. Pain of a neuralgic character is often present at night, so that the patient is unable to sleep, or to lie on the affected side. At length, as the original glenoid cavity undergoes absorption, and as new bone is being deposited around its margin, a large articular hollow is developed, extending to, and often in part formed by, the eroded coracoid process (Fig. 59). At the same time the head of the humerus becomes enlarged, partially worn away, misshapen, and displaced upwards and for-

wards, so that the appearances presented are those of an old traumatic subcoracoid dislocation. In younger subjects the shoulder, in common with other joints, may be the seat of anatomical changes similar to those present in the early stage of arthritis deformans. Such changes are due to septic infection, from, for instance, the urethra, in chronic gleet, or from the vaginal or uterine mucous membrane. These cases are very prone to end in fibrous ankylosis.

A remarkable anatomical feature is sometimes observed in connection with arthritis deformans of this joint. It consists of the separation of the end of the acromion, so that this process has the appearance of having undergone a fracture which has been repaired by fibrous union. The line of separation varies in different cases. In some instances merely the extremity, in others a considerable amount, is detached. In a specimen in the museum of St. Bartholomew's Hospital the acromion is divided in two places, the resulting fragments being maintained in position by partially ossified bands of fibrous tissue. Another result is that the long tendon of the biceps becomes displaced from its groove, and is often completely worn through. In these cases the lower end of the tendon is found adherent to the upper end of the groove or to one of the tuberosities.

Diagnosis.—This is usually easily made. The age of the patient, the presence of similar disease either in the opposite side, or in some of the other joints, and the manner in which the affection has been developed, together with the local symptoms mentioned above, will serve clearly to indicate the nature of the case. In some instances in the shoulder, as in the hip (p. 409), arthritis deformans follows an injury, and it may then be met with apart from any manifestation of the disease elsewhere. This form is inveterate, and of the same active type as that which is occasionally

seen in the hip, and it is equally slow to respond to treatment.

The general *treatment* is given at p. 162 *et seq.* Local means consist of warmth, hot douching vigorously carried out, a series of small blisters when pain is marked, massage and gentle exercise of the joint. In some cases the continuous electric current is of use both to relieve pain and to retard muscular wasting. Considerable benefit is frequently obtained from radiant heat.

Stiffness often depends to some extent on the formation of adhesions round the joint, and good may sometimes be done by giving an anæsthetic and very carefully manipulating the joint by first rotating the humerus on its long axis, and then carrying the elbow in different directions through a limited range. This proceeding, however, should be adopted only when the patient is suffering great inconvenience from stiffness of the joint, and when the articular surfaces appear to have undergone no very extensive alteration in shape. In advanced cases manipulation will not only be useless, but it will in all probability considerably aggravate the disease.

Charcot's disease.—This is less common in the shoulder than in the knee, hip, or elbow, yet well-marked examples are sometimes met with. In its early period the affection is usually indistinguishable from arthritis deformans, and it is often only when evidence of disease of the nervous system is present that the true nature of the malady is disclosed. In its later stages the changes in the joint still resemble, though they tend to exceed, those that are met with in arthritis deformans. The articular surfaces are extensively altered. The glenoid cavity is replaced by a large articular hollow, bounded above and in front by the acromion and the coracoid process, and below by a mass of new bone springing from the axillary border of the scapula, and produced apparently by ossification of the long head of the triceps.

The head of the humerus disappears, and the upper end of the bone is converted into a large club-shaped mass, which is drawn upwards and forwards as in subcoracoid dislocation. The joint-capsule, together with the neighbouring bursæ, is from the first distended by a large collection of turbid synovial fluid. The joint is loose and flail-like, and grating is felt on movement. Sometimes the upper end of the humerus drops away from the scapula towards the axilla, but admits of being easily replaced. Movement, however, causes little or no pain, and it is surprising to see the extent to which the arm can still be used. The shoulder is attacked usually only after other articulations have become involved; and no local treatment likely to be of material service, beyond support and rest, can be recommended.

For **syringo-myelia**, see p. 212.

Synovial cysts presenting the characters of enlarged bursæ are not rare in connection with the shoulder-joint. It is important to remember that these cysts may be in direct connection with the articulation (p. 244). They rarely call for active interference. Should any operation be undertaken, asepsis must be the first consideration. Enlargement of the bursa beneath the deltoid muscle is noticed at p. 237 *et seq.*

Syphilitic disease of the shoulder-joint is, I think, extremely rare. I have never recognised an example of it.

For the diagnosis and treatment of **adhesions** about this joint, resulting from injury or other causes, see p. 534.

CHAPTER XXVIII

DISEASES OF THE ANKLE

Tuberculous disease.—Although the ankle-joint lies close beneath the skin, so that it is readily accessible to examination, there are many instances in which it is by no means easy to avoid falling into an error of diagnosis respecting its real condition. At first sight the evidence that it is in a state of advanced disease may seem obvious, and yet the joint may be perfectly sound ; and I have witnessed more than one instance in which Syme's amputation has been performed under the belief that the joint was disorganised, but in which it has proved that the disease was situated entirely in some of the surrounding parts. It is therefore necessary to consider the question of diagnosis with more than ordinary care.

Disease may commence either in the synovial membrane, as is frequently the case, or in one of the bones that are in the immediate neighbourhood : in the lower end of the tibia or perhaps the fibula, in the astragalus, or in the os calcis. The *symptoms* of synovial disease are swelling, limping, muscular wasting of the leg, stiffness of the joint, heat of the surface, pain, tenderness. I have endeavoured to place these different signs in the order of their relative value ; they vary, however, so much in different cases that each one must be considered important and should be carefully estimated. The beginner will be wise to remember that here, as well as in the case of the hip-joint, he is likely to fall into serious error unless he proceeds with caution.

1. Swelling is always an early and a distinct symptom, taking the form of puffy fullness, to be detected in front, where it fills out all the natural depressions and masks the course of the extensor tendons; at the sides around the malleoli; and at the back, where it produces enlargement on either side of the tendo Achillis, and gives the joint an appearance of increased width. Swelling in this last situation may easily escape notice unless a careful comparison is made with the opposite side. It is often well marked when swelling elsewhere is very slight, and should therefore always be looked for. (See Fig. 60.) 2. Limping may be the first symptom observed by the parents, but it is sometimes striking to see how well a child will walk even though tuberculous synovitis has already made considerable progress. 3. Wasting involving the muscles of the calf takes place early, and is often very marked. Even when the limb is not distinctly smaller on measurement, the muscles can be felt to be flabby and less firm than those of the opposite leg. 4. Stiffness of the joint is usually present when full flexion and full extension are approached, but it is important to notice that the patient will often allow the joint to be moved, and will, indeed, move it himself, through all its middle range with unrestricted freedom. It is only when the extremes are approached that the impairment is detected. 5. Heat of the surface is an important symptom when it is present; but there are so many instances in which it is wanting that its absence must not be depended on as an indication that there is no disease. The same must be said of pain and tenderness. 6. Pain, though it is present in the more acute cases, is often absent, so that parents cannot persuade themselves that the condition of the joint is serious; and even a surgeon, who places pain before swelling and muscular wasting as a test symptom, will probably fall into error. 7. Tenderness may also be present, but

frequently it is so entirely absent that it must not be trusted. On another ground it is a symptom to be very cautiously estimated, for rough pressure may give



Fig. 60.—Synovitis of the ankle with periarticular thickening. The obliteration of the depressions on either side of the tendo Achillis and the muscular wasting of the calf are well exemplified.

pain in a healthy joint, which may be easily mistaken for the evidence of disease.

Diagnosis.—The conditions with which disease of

the ankle-joint is liable to be confused are disease (1) of the lower end of the tibia, (2) of the tarsus, (3) of the synovial sheaths of the surrounding tendons. The recognition of the exact seat of mischief is not material while disease is still incipient, for the treatment is the same, and consists of perfect rest, secured by means presently to be described. Its importance arises when operative interference has to be considered, and the question is whether it is the end of the tibia, the tarsus, or the joint itself that is involved. By means of radiograms the situation and extent of the disease can usually be accurately gauged. In obscure cases neither the situation of swelling nor the position of sinuses can be entirely depended upon. The only reliable evidence, apart from a skiagram, is that which is derived from the direction a probe or a director takes when carefully used.

[4] The patient should be under an anæsthetic, so that a thorough examination can be made. If any doubt remains whether or not the instrument enters the joint, the surgeon should proceed with caution until, by an exploratory incision, this point has been set at rest. But guidance may often be obtained by noticing that, though at some parts swelling seems to involve the joint, in other parts the joint preserves its natural outline. Swelling may, e.g., be well marked in front and on the outer side, but absent from the inner part of the joint. Swelling thus limited may indicate that the articulation itself is not affected. So far as I have observed, the joint is not rarely sound when to external appearance it is itself diseased. The following case will illustrate this point:—

[5] A child, aged 3, had a sinus of five months' duration on the front of the foot, opposite the articulation between the tibia and the astragalus. The surrounding soft parts were red and considerably swollen, and the swelling extended backwards around the

malleoli. There was considerable discharge. The surgeon who was treating the patient, believing that the ankle-joint was incurably diseased, proceeded to perform Syme's amputation. But, on making the anterior incision into the joint, he found that the articulation itself was perfectly healthy, and that the disease consisted merely of necrosis of the head of the astragalus, with the formation of a small sequestrum that might have been very easily removed. In a second instance, Syme's amputation was performed for disease limited to the os calcis, but which was believed to involve the ankle-joint.

The *treatment* of tuberculous disease of the ankle must consist, in the early stage, of applying a pair of carefully moulded leather splints (Fig. 61), and not allowing the

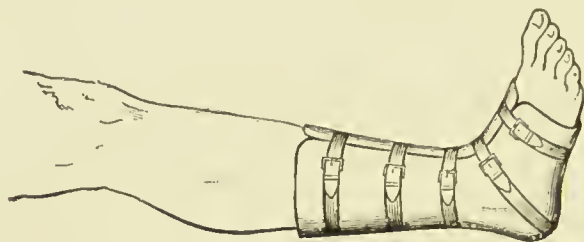


Fig. 61.—Leather splints for disease of the ankle-joint.

patient to put the foot to the ground. Crutches should be used, and a patten worn on the boot of the sound leg. In moulding the splints, care should be taken to keep the foot nearly at a right angle with the leg. If the foot is put up at a more open angle, and if any stiffness should remain, the heel cannot be brought to the ground, and, as I have twice seen, it may be necessary to divide the tendo Achillis and bring the heel down, as in ordinary talipes equinus. In one instance in which the extremely rare event of bony ankylosis of the ankle-joint occurred (after prolonged suppuration), and in which the foot became fixed at an angle of 120° , the patient walked with great insecurity and difficulty, and would, I think, have had a more useful limb had Syme's amputation been performed. The splints should be constantly worn, by night as well as by day. If a leather splint cannot be

afforded, plaster may be used. Incipient cases (those in which the disease has existed for not more than a month or six weeks) may thus be cured in six months, if the patient is kept for many hours a day in the open air. In instances of longer standing, nine months or even a year may be required. But the result is not doubtful. Perfectly free movement will usually be regained, and the joint will escape serious injury. If suppuration occurs an incision must be made, pus evacuated, any carious bone present removed, and the cavity filled with iodoform emulsion and drained. If healing is long delayed, arthrectomy should be performed (p. 330).

In the convalescent stage, and when the joint is free from swelling, the patient (if he is at any age above 6 or 7) may be allowed to go about with a Thomas's knee-splint and crutches (p. 397), but he should still constantly wear the leather splints for the ankle. A convenient method of getting about in these cases is with the leg flexed and supported on a peg stump. In cases in which disease begins in the lower end of the tibia, the treatment given at p. 34 must be adopted. This will ensure, in a very large majority of instances, that the joint does not become involved. When either the astragalus or the os calcis is the seat of tuberculous disease, rest secured by leather splints will usually lead to repair; but when suppuration has already occurred and the disease continues to advance, the affected bone may be dissected out. I have met with several cases in which a very useful foot has been obtained after removal of the astragalus, and in which the false joint between the os calcis and the bones of the leg admitted of a considerable amount of flexion and extension; while in instances in which the os calcis has been dissected out, though the prominence of the heel is lost, and the limb is shortened so that the malleoli occupy a lower level than natural, good flexion and extension remain.

When the necessary addition to the thickness of the heel of the boot is made, the patient walks firmly and well on the limb.

There can be no hesitation in allowing that an admirable stump is obtained by Syme's amputation. Yet the loss of a foot must always be a serious matter; and certainly, if the treatment which I have just described, and which has been so strongly urged by many authorities, is brought to bear, the removal of the foot can in a very large proportion of cases be avoided.

Acute suppurative arthritis.—Whether originating in some form of blood-poisoning, in septic infection through a wound, in the extension into the joint of mischief in one of the contiguous bones, or—as I have twice seen—in acute inflammation following prolonged exertion of a joint that had previously been unsound, acute suppurative arthritis of the ankle is characterised by severe pain, rapidly increasing swelling, redness of the skin, and the constitutional disturbance and high temperature which accompany these local symptoms. The formation of pus is indicated by increase of swelling and pain, by a further rise of temperature, often by rigors, and by the appearance of redness, œdema, and pitting of the surface on pressure. The treatment is that laid down for acute arthritis at p. 128. Should it be believed that the joint has become disorganised, should discharge continue profuse, should the temperature remain high, and should the patient be losing in general condition, Syme's amputation had better be at once performed, not only because it may be dangerous to the patient's life to postpone active interference, but also because there is no prospect that, even if the foot can be preserved, the limb will be more useful than will be the well-formed stump left after amputation.

Acute arthritis of infants.—This affection (p. 26)

presents no features in the ankle-joint that call for detailed description. It runs its course quite as rapidly here as elsewhere, and, unless active measures are at once adopted, the joint, together with the lower ends of the tibia and fibula and the tarsal bones, will be destroyed. A case is mentioned at p. 37 in which such complete disorganisation had occurred that, though the parts had healed, amputation was necessary. Early evacuation of matter, however, with subsequent rest and antiseptic dressing, will often lead to repair, when other joints are not involved, and when the general strength remains good.

Osteo-arthritis.—Not so frequent here as in many of the other joints, this disease is still occasionally met with. Both ankle-joints are usually affected, and the nature of the case is generally disclosed by the presence of the malady in other articulations. The symptoms are stiffness, weakness, and pain, attended with swelling, and very soon with a disabling and very intractable form of flat-foot, due in part to weakness of the muscles, but largely to the fact that the ligamentous structures in the sole become involved. In many instances talipes valgus is also developed.

Treatment.—The general management of these cases is given at p. 162 *et seq.* As for local means, the patient must be directed to be on his feet as little as possible, especially when the disease is in a period of exacerbation, and to take the opportunity of sitting instead of standing whenever he is able to do so. He should be supplied with boots made of soft leather, and large enough to allow for variations in regard to swelling. Some patients, however, can only wear loose cloth boots. An outside iron with T-strap, such as is used for ordinary flat-foot, will be serviceable in patients not much past middle age; but in elderly persons whose muscles are weak, the extra weight of this apparatus

is an objection to its employment. Relief from pain may be secured by temporary rest, blistering, and the use afterwards of hot-douching. Passive movements, during which the foot is carried up well within a right angle, will help to prevent stiffness, and massage will do something to arrest muscular wasting.

CHAPTER XXIX

DISEASES OF THE KNEE

THIS joint, like the hip, presents many important characteristics of its own which must receive consideration when the diseases to which it is liable, and their treatment, are being discussed.

1. The knee is the largest joint in the body, alike as regards the size of the articular ends of the bones, the extent of the synovial membrane, and the area of its cavity. Any affection of this joint is necessarily, therefore, on a large scale, and the various forms of acute inflammation by which it may be attacked are liable to be attended with a proportionate amount of constitutional disturbance. Thus, in acute traumatic arthritis, should sepsis occur, a collection of pus to the extent of several ounces may rapidly form, and, unless at once evacuated, may burst the capsule, and become widely extravasated in the intermuscular spaces of the limb—a local condition which is accompanied by grave general symptoms.

2. Owing to the shape of the articular ends of the two bones by which it is mainly formed, and the way in which the shallow facets of the tibia are constructed to slide and rotate upon the rounded condyles of the femur, displacement readily occurs when the joint is in the posture of semiflexion, which it at once assumes as the position of greatest ease when it is involved in inflammation. In this attitude the tibia is in contact with the femur over only a very limited surface, and is easily drawn backwards towards the popliteal space by the hamstring muscles.

3. Whatever be its explanation, the fact is well known that the muscles surrounding the knee are, more than those surrounding any other joint, the hip perhaps excepted, liable to be the seat of continuous and often severe reflex contraction whenever inflammation is present. In these circumstances the joint is subject not only to the injurious results of interosseous pressure (p. 514), but also to the occurrence of irremediable deformity, as the bones of the leg become displaced outwards and backwards towards the popliteal space, abducted, and rotated on their long axis outwards.

4. The joint is formed by the apposed ends of two long and powerful levers : it is situated in the middle of a limb which contains an elaborate system of powerful muscles, and which is connected with the trunk by means of a joint that allows of free movement in every direction. It is an articulation, therefore, which it is very difficult to place at complete rest : it is one also to which every movement of the trunk is readily conveyed.

5. The ends of the femur and tibia which meet at the knee are those at which growth in the length of the lower extremity is mainly effected, and any extensive interference with them, either by disease, or in surgical operations, is liable to be followed by arrested development of the limb. All these are circumstances with which the surgeon has to reckon, and they conspire to render treatment of diseases of the knee in many respects more difficult than is the case with any other joint. I shall endeavour, as I proceed, to indicate how the various difficulties that offer themselves may best be overcome.

In alluding to the characteristics of the knee, I may add that this joint is singularly liable to disease. Some of the affections which it presents are rarely seen in any other articulation ; while, if we pass in review the

different diseases that involve the joints, and note their seats of election, it is the knee in nearly every instance that is most prone to be attacked.

Simple synovitis of varying degrees of severity is, on account of the exposed position of this joint and its great liability to injury by falls, blows, and sprains, of very common occurrence. The gravity of the case will vary, not only with the degree of violence that has been inflicted, but with the general health and the constitutional peculiarities of the patient. As a rule, the prognosis is quite favourable if the necessary treatment is adopted in good time. Suppuration is very rare, repair is usually complete, and free movement is regained. If, however, the patient is either gouty, or tuberculous, or the subject of arthritis deformans, the original traumatic inflammation may pass on into one of these specific forms. It is especially necessary to remember this in the case of tuberculous patients. Instances are occasionally met with in the knee, and, indeed, in the other joints also, in which inflammation, due in the first place to a blow or wrench, gradually assumes the character of tuberculous disease. The danger is that this alteration in the type and tendencies of the case may escape notice. I have stated that prognosis in simple synovitis is good if only appropriate treatment is brought to bear without delay. But should the affection be allowed to progress, a tedious and destructive form will be developed and, continuing for an indefinite time, will lead to irreparable structural changes in the joint. It is the duty of the surgeon to place the state of the case clearly before the patient. A fortnight or three weeks devoted to treatment at the outset will often avert the occurrence of changes which, if they were left to advance, would end in serious injury to the joint.

Symptoms.—Synovitis is indicated by stiffness, swelling, pain, and heat. When the affection is acute the

joint, assuming the position of greatest ease, is flexed at an angle of about 120° , and any attempt to move it is attended with severe pain. Swelling is considerable, and is observed to follow the outline of the synovial cavity. It obliterates the natural depressions at the sides of the patella and ligamentum patellæ, and is seen to extend upwards beneath the quadriceps extensor, where, in the complete absence of ligaments, the synovial membrane readily becomes prominently distended. In examining a knee for the purpose of ascertaining whether it contains fluid, the surgeon must be careful to place the patient in the horizontal position, with the limb supported, so that the quadriceps extensor and the other muscles are completely relaxed. Unless this point is attended to, even a large amount of fluid may easily escape detection. Fluctuation can be obtained in all the axes of the joint, transversely as well as longitudinally and obliquely. The patella, raised by the fluid collected beneath it, rides on the summit of the swelling, and when pressed upon is felt to dip and strike the condyles of the femur. But (*a*) in cases in which the amount of fluid in the joint is slight, the riding of the patella and its concussion against the femur can only be detected when the hand grasps the front of the thigh just above the joint, and is made to press the fluid down and concentrate it in the lower half of the articulation; (*b*) when the joint is tensely distended the patella is so much lifted up that only a forcible degree of sudden pressure (which would give severe pain) will make it “duck,” and “tap” on the condyles of the femur; (*c*) when the synovial membrane is swollen, its folds around the patella act as soft pads which prevent any sensation of concussion between the bones. These three sources of error must be carefully borne in mind.

Pain is very variable in its amount. When synovitis

is of moderate severity, pain, when the joint is at rest, may be only very slight; but in acute inflammation, attended with rapid effusion, it is often extremely severe, and is described by the patient as being of a tense, bursting character. Pain, however, cannot be regarded as affording any very reliable index of the severity of the case, for it varies widely with the sensitiveness of different patients. In acute synovitis the surface-heat over the joint is often considerably raised.

Treatment.—In acute synovitis the only safety lies in placing the joint at once in a condition of complete rest. In these cases it is a grave error to depend merely on a pillow. The limb must be fixed and supported on a firm and accurately adjusted splint. The most convenient apparatus is either a McIntyre splint, or an ordinary back-splint swung to the top bars of a cradle. Should the joint be considerably flexed, an anæsthetic should be given, and the limb should be brought into a position a little short of full extension. This can be done, when the muscles are relaxed, without the use of the slightest force; and the step is a necessary one, for not only is it very difficult, from a mechanical point of view, to treat an inflamed knee-joint satisfactorily when it is considerably flexed, but when it is in this position dislocation of the tibia backwards is not unlikely to occur. Care must, of course, be taken to avoid tight bandaging above the knee. As soon as the limb has been thus placed at rest the joint should be covered with an evaporating lotion, or an ice-bag should be applied. If tension is considerable the joint may be aspirated. It is a well-known general fact that mere tension aggravates the inflammatory process, and that immediate relief often follows its removal. It is certainly the case in the instance before us. The proceeding, however, must be carried out with the most scrupulous care. A fine, sterilised needle

should be used, and all possible aseptic precautions taken. The withdrawal of three or four drachms of fluid will often afford marked relief. In case of a violent wrench to the joint, which it is believed has been attended with large hæmorrhage into the synovial cavity, it may be advisable to remove the effused blood, by aseptic incision, at once, on the ground that if it is allowed to remain it may, as it becomes organised, lead to the formation of adhesions which would seriously impede movement. Here, as before, the utmost care must be exercised. Effused blood, however, unless in large amount, will be absorbed, so that active interference is unnecessary.

When there is much muscular spasm, weight-extension may be combined with the splint; 6 to 10 lb. being used in adults, and 3 to 6 lb. in children. It is very important that the extension should always be made in the long axis of the tibia. (*See p. 518 et seq.*) Treated early, in the manner just described, inflammation will usually subside in the course of a few days, and swelling, pain, and heat will gradually disappear. If there is any material delay, two or three blisters should be applied, one healing before the next is put on. Then, should swelling still remain, the joint may be covered with strong mercurial ointment spread on lint, and be strapped with emplastrum saponis. In addition, gentle compression with a Martin's elastic bandage, applied over wool and not too tightly adjusted, may be employed. The latter is a very useful method. In several instances it has produced the absorption of a considerable amount of fluid in the course of a few days. It also affords the patient a comfortable sense of security and of support to the joint.

It is often difficult to determine when the joint may be used. There is a twofold liability to error on this question: first, that rest may not be sufficiently

prolonged ; and, secondly, that it may be continued after all necessity for it has passed away. The former is so widely recognised that it need not now detain us. The latter calls for more definite notice. Cases are sometimes met with in which, long after all active mischief has subsided, the patient has been directed to move about on crutches, and not to bear any weight upon the limb. In these instances the joint has been kept carefully strapped. Such advice appears to partake too much of routine, or of subserviency to a vaguely applied general rule, and to indicate a want of discrimination between one case and another. It also exposes the surgeon to the vexation of finding that his patient has been set right by some irregular practitioner, who, by the rapid cure he has effected by moving the joint, has, in the eyes of the patient and his friends, fully proved his assertion that one of the small bones was out, and that he has put it in. Such instances, ludicrous in their simplicity, but on that account all the more annoying, were much more common only a few years ago than they are now, yet they still occur with sufficient frequency to justify a special allusion to them.

Reliable rules in such cases are these : As long as the joint is considerably swollen, or as long as swelling that does not soon subside follows movement ; as long as the joint is hot, or as long as heat that does not soon pass off is provoked by movement ; as long as there is persistent pain in the joint ; and, a fortiori, as long as these symptoms are combined, rest, blistering, and pressure are still called for. On the other hand, when swelling has disappeared, when the surface is free from heat, and when there is no pain at night or as long as the joint is at rest, movement of a tentative character should be used, and should be continued, if it is followed by neither pain, heat, nor swelling, or by only such as soon disappears when the limb is again at rest. Probably

pain is the most deceptive symptom. It is often complained of, although the joint is quite fit for work. It depends partly on trivial adhesions, and in part on mere hyperæsthesia. Pain, however, may be disregarded when it occurs alone and unassociated with either heat or swelling. The patient should be advised to use the limb ; or if the joint is stiff it should be examined under an anæsthetic. It will then probably be found that it can be moved without force, although some slight adhesions are felt to give way. In such instances, if strongly assured that the joint is fit for use, and that the pain is not of serious import, the patient will very soon regain the full use of the limb (*see case of Robert D—, at p. 542*), and pain will disappear.

Acute suppurative arthritis.—This may ensue from a wound ; it may arise when pus, formed in the course of disease of the articular end of one of the bones, makes its way into the joint, or, again, in the course of some general infective disease. It is also met with after compound fracture extending into the joint, and sometimes from an incautiously performed surgical operation, in the course of which the articular cavity is unintentionally opened, as when a bursa whose connection with the joint has been overlooked is punctured without the strictest precautions against sepsis, or when the synovial membrane is wounded during the removal of an exostosis or of an enlarged bursa patellæ. (*See p. 243.*) In accidents of this kind, if the surgeon at the time is working with due precaution against septic infection of the wound, no mischief will follow ; but the necessity for the exercise of great care should never be lost sight of.

The *symptoms* are usually of no doubtful interpretation. The inflammatory process is marked by its violence and the rapidity of its development. There is excessive pain, especially on movement, or even when the bed is

jarred by a heavy footstep in the room. Spasm of the surrounding muscles leads to starting of the limb. Swelling quickly increases, and soon amounts to distension; fluctuation becomes distinct; the skin assumes a suffused tint, and perhaps œdema occurs, so that the surface pits on pressure. These local signs are attended with all the evidences of severe constitutional disturbance. The temperature rises to 103° or 104° , the patient is restless and distressed, both pulse and respiration are accelerated, he loses his appetite and power of sleep, and he also rapidly loses flesh. There may be repeated rigors.

Treatment.—No time must be lost in the prosecution of the necessary treatment. The limb must be placed on a back-splint and swung. If the case is seen early, the joint should be assiduously irrigated with iced water. Pain may be relieved by the hypodermic injection of morphia. Should effusion so increase that the synovial membrane is distended, the joint should at once be aspirated, and cultivations taken from the fluid. If only sterile synovial fluid (which will often be blood-stained) is drawn off, nothing more, for the present, need be done; but if the fluid is purulent, or even distinctly turbid, the joint should be freely opened by two incisions, one on each side of the patella, and well irrigated with carbolic lotion (1—40), or with a solution of perchloride of mercury (1—2,000). Two short drainage-tubes should then be inserted, and the joint enclosed in a large antiseptic dressing. If at the time of operation there is extensive suppuration, continuous irrigation should be made use of by means of a douche-tin and rubber tubing and a mackintosh sheet so arranged beneath the knee that the fluid will drain away into a bucket below the bed. For continuous or repeated irrigation boracic lotion or iodine water (1—400) should be used. Vigorous treatment on these

lines, if employed early, generally arrests the affection, and the patient will recover, sometimes with bony or close fibrous ankylosis ; but sometimes, as I have seen, with perfect movement of the joint. In less favourable cases suppuration, in spite of good drainage and irrigation, continues to be free, the temperature remains high, the patient loses flesh, and the joint, from erosion of its ligaments, tends to undergo displacement. In these circumstances the question of amputation must be raised. The necessity for this step can only be determined in a particular case by a consideration of all the symptoms that are present. It can only be said here that the operation will seldom be called for if means are taken to prevent displacement, if irrigation, combined with good drainage, is perseveringly followed out, and if the patient's strength is maintained by quinine and a nutritious diet and the moderate use of stimulants. As in all cases of suppurative arthritis, vaccines should be made from cultures of the infecting micro-organism, and used at the earliest possible moment.

Acute arthritis of infants is met with in the knee perhaps more often than in any other joint. The symptoms are clearly marked. In an infant under the age of two years, and frequently only a few weeks old, the joint is found to be stiff, painful, swollen, and hotter than its fellow. In the course of a day or two, or it may be even in a few hours, the articular cavity becomes distended, and fluctuation, apparently close under the skin, is detected. Generally the child looks pale, ill, and distressed, constantly cries, wastes rapidly, and has a temperature of 100° to 102° . If an incision is made on either side of the patella, the joint irrigated, and drainage established, discharge will gradually diminish, the general condition of the child will improve, and, as I have several times seen, perfect recovery may

take place. If, however, matter is allowed to collect, it will soon, after distending the joint, burst through the synovial membrane (probably beneath the quadriceps extensor, where the membrane is unsupported by the addition of a capsule) and will escape into the surrounding structures. All the soft parts, including the ligaments, and then the ends of the bones, will be destroyed, and the joint, should the patient survive, will be left flail-like and, to a great extent, useless. More frequently, however, especially when other joints are similarly affected, and when in them, as in the knee, the requisite incisions are not made, death will result from exhaustion, or from septicæmia.

Treatment.—In the case of so small a limb, all that is required by way of mechanical support is a simple back-splint, made of tin and padded. Often, indeed, it is best to leave the joint without apparatus, so little does the child move the limb. As repair goes on, care must be taken that no contraction ensue. Any tendency to this must be met by placing the limb in a well-fitted back-splint, and subsequently, when healing is complete, gentle passive movement may be resorted to.

Osteo - arthritis.—This affection involving the knee-joint is somewhat more frequent in women, especially at the time of the menopause, than in men. It usually commences between the ages of forty and fifty. It may be limited to one knee, but cases are more frequent in which both joints are attacked, either about the same time or consecutively.

The first *symptoms* are stiffness, especially after rest, and pain. Stiffness usually passes off with movement, but pain, though sometimes only slight, is not rarely so severe that the patient is unable to follow any active occupation. Pain may involve the whole articulation, but much more commonly it is felt chiefly at one spot, often over the inner condyle of the femur, and is

accompanied by marked tenderness on pressure. Swelling varies considerably in amount. It may be scarcely appreciable, but often the joint is puffy and somewhat enlarged. Sometimes the disease commences with the collection of several ounces of fluid in the joint, so that the outline of the capsule is clearly displayed. There may be some heat of the surface, but usually the joint is quite cool. The nature of the disease, when fully established, is almost always disclosed by the presence of grating or cracking, or a sensation as if there were coarse wet sand in the joint, felt when the hand is placed on the knee and the patient flexes and extends the leg upon the thigh. The grating and cracking may often be heard, as well as felt, during movement of the articulation. Distinct grating and cracking are due to calcification and erosion of the articular cartilages, or to the formation of rough cartilaginous nodules in the synovial fringes, which are rubbed together when the joint is moved. The sensation as if wet sand were being compressed seems to depend on the altered condition of the synovial membrane, the fringes of which become hypertrophied and studded with tufts and slender processes; and these, in different degrees of vascular congestion, convey a feeling of creaking or harsh friction as they slide upon each other, somewhat resembling that which is present in teno-synovitis. That the sensation is thus produced is, I think, rendered probable by the fact that while the creaking is sometimes distinct and plentiful, it is, in the same case, on other occasions, wholly or almost entirely absent. It may be present on one day and absent on the next, and I have known it disappear completely a day or two after the joint has been blistered.

The general tendency of osteo-arthritis is to advance. The changes described at p. 148 *et seq.* are developed, and gradually distortion, and a crippled condition of

the articulation, are produced (Fig. 62). In many cases, however, there are periods in which, though the joint is more or less stiff after rest, and though creaking may be felt, the patient has little inconvenience, and is able to move actively about upon the limb. In the early stages the affection is, to a great extent, amenable to treatment. Gradually, however, as time goes on, the joint is apt to become more and more stiff, and weak. It also becomes enlarged, partly, in some cases, from effusion into its cavity, but generally from thickening of the synovial membrane and the formation of new bone about the articular margins (Fig. 17). Often considerable masses of fibro-cartilage that have undergone calcification can be felt deposited in the synovial membrane. Some of these may be detached, and constitute one of the forms of loose bodies in the joint. In some cases no effusion is at any time to be detected. In others, effusion occurs to a very large amount. In the latter cases the knee becomes extremely weak, so that the patient has great difficulty in going up and down stairs, or in rising from a low seat, and, at last, even in walking any distance on level ground. Osteo-arthritis of the knee is

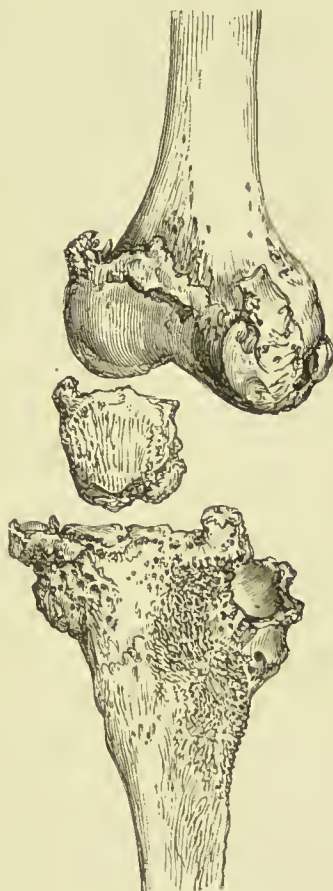


Fig. 62.—Advanced osteo-arthritis of the knee-joint.

(From a specimen, No. 696, in St. Bartholomew's Hosp. Mus.)

often associated with disease of a similar kind in other joints, e.g. in the terminal phalangeal joints (Heberden's nodes), or with antecedent attacks of rheumatism or gout; but it frequently arises independently, and must then be regarded as mainly dependent on textural degeneration combined with processes of a low form of inflammation (*see* Chapter IX.). In some instances, again, it follows injury, and when this is the case it usually assumes an active form and obstinately resists treatment. In these cases the joint, within three or four months, becomes distorted by changes in the shape of the articular surfaces, and extensive lipping at the borders; the ligaments are partially destroyed, and the limb is painful, and very weak and crippled.

Treatment.—When the disease tends to be active and there is much pain, the joint should be kept, for the time being, at rest in the horizontal position, and should be sharply blistered. Every day's experience shows that considerable improvement, in respect both to the subsidence of stiffness and swelling, and the relief of pain, follows free blistering. Four or five blisters, an inch and a half or two inches square, should be applied in succession, each in a fresh place, one being allowed to heal before the next is put on. When the skin has healed, the joint should be well douched for ten minutes night and morning with the hottest water the patient can comfortably bear, and, if pain continues, the knee should be wrapped at night in opium liniment sprinkled on lint and covered with oil-silk. If swelling remains, a Martin's elastic bandage may be applied, but it must not be drawn at all tightly round the joint. A recent method of treatment by ionisation is highly recommended by some writers. Various substances have been introduced into the joint by this method.* When the patient

* For an account of this method of treatment the reader is referred to a paper by Dr. Finzi (*Lancet*, March 13th, 1909).

resumes the use of the limb, he should take only very moderate exercise, and walk with a stick. The joint must be covered with a loose knee-cap or flannel bandage to maintain a uniform temperature. In chronic osteoarthritis similar remedies should be employed. Moderate exercise, hot-douching or hot-air baths, occasional blistering, and elastic pressure are the best local means within our reach. When pain has subsided, the nutrition and strength of the muscles may be much improved by massage. The general treatment is described at p. 162 *et seq.* The management of large effusion into the joint is alluded to at pp. 21, 22, and the question of endeavouring to restore movement in cases of osteoarthritis is discussed at pp. 163, 164.

Tuberculosis.—The knee-joint is a frequent seat of tuberculous disease. This may originate in the synovial membrane or in the articular end of one of the component bones. In the latter case, in children, it begins either in the rapidly growing tissue of the diaphysis immediately beneath the epiphyseal plate; or, although more rarely, in the substance of the epiphysis, in the neighbourhood of the ossifying nucleus (*see* Fig. 63). In adults, when it attacks the bones, it may begin in any part of the cancellous tissue of the articular ends. It is stated in a later chapter (p. 415) that in a large majority of cases of tuberculous disease of the hip the affection originates in the bones. In the knee, however, probably about half the cases begin in the synovial membrane and half in the articular ends. This fact, that approximately as many as half the cases of tuberculosis of the knee are synovial in their origin, has an important bearing on the ultimate result, and also on the time required for repair. For, undoubtedly, synovitis is a much less formidable condition than osteitis, and one from which recovery may take place in a much shorter period. Whether in a particular case the disease has started in

the synovial membrane or in one of the bones can be determined only in the incipient stage. At this period, however, a trustworthy opinion can generally be formed. In synovitis the early symptoms are swelling of the membrane, slight heat of the surface, early muscular wasting, and—except when the affection is more than usually acute—absence of pain even on movement, or when weight is thrown upon the limb. When the disease

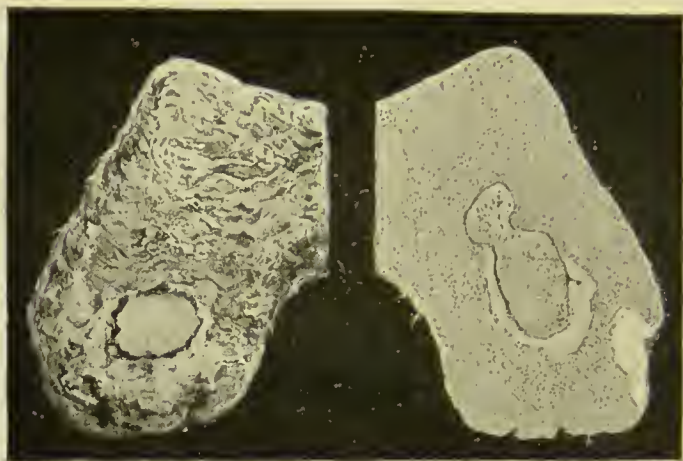


Fig. 63.—Tuberculous disease of the knee with necrosis commencing in the lower epiphysis of the femur. The thin slice of bone, both surfaces of which are illustrated, was removed in an excision of the knee.

begins in the end of one of the bones, the first symptoms are pain in walking and marked lameness, tenderness on pressure of some part of the bone, and perhaps surface-heat over the tender area, with an absence of marked synovial swelling and of muscular wasting. This last symptom, however, although originally absent, will soon make its appearance. An X-ray photograph should always be taken, and may clearly indicate either the absence or the presence of disease in the bone. As to the date of recovery in synovitis, this may occur, under strict treatment from the onset, in the course of six

or nine months. In bone-cases of a like grade of severity the time required will be from nine to twelve months, or even longer. Often, as has been mentioned before, tuberculous disease is preceded by a fall, or by some other local injury by which the resisting power of the tissues is impaired, and as the result of which they become occupied by inflammatory products. It is in tissues so circumstanced that the tubercle-bacillus meets with a highly appropriate soil.

Symptoms.—These are stiffness, swelling, and soon some muscular wasting, while sometimes pain and surface-heat may also be detected. Stiffness is apparent in the fact that, while the joint can be flexed, it cannot be fully extended, a defect that is clearly seen when the two limbs are compared. This is a very material piece of evidence. Swelling takes the form of a puffy condition of the joint at the sides of the patella, and its ligament, or, when it is more considerable, of general fullness and enlargement of the joint, so that its various normal depressions are filled in, and the whole outline is rounded or fusiform. Swelling may also be detected by careful measurement of the two joints at the same level, and when they are in the same position. Muscular wasting, a very important feature, is most marked in the lower third of the thigh. It is sometimes already present at the end of three or four weeks; but, even if it is slight, it must not be made light of. Nor must it be forgotten that, considering the small circumference of the limb in a child, even a quarter of an inch represents a decided degree of atrophy. If the disease is allowed to advance, as it inevitably will unless opposed by adequate treatment, the synovial membrane becomes swollen and infiltrated, and can be felt thickened and elastic on pressure. The joint becomes more flexed, and the bones of the leg undergo displacement in two directions: (*a*) they travel backwards and outwards, so that

the head of the fibula is rendered abnormally prominent in the outer part of the popliteal space; and (b) they become rotated on their long axis, so that the foot is everted. When this composite displacement is combined with considerable flexion, the limb is useless for progression, for the toe does not reach the ground, nor can the patient bear any weight upon the joint. In the later stages of disease suppuration not infrequently occurs.

The *treatment* consists in the persistent use of leather splints, such as are shown in Fig. 64. The statement so often made already respecting these tuberculous affections must be repeated here. If the disease is detected

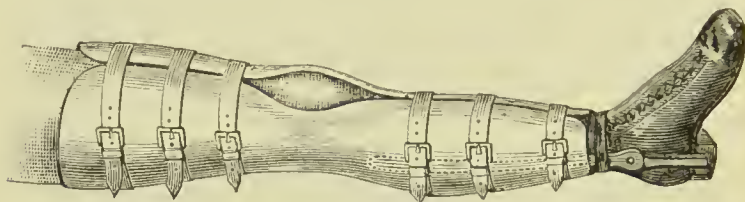


Fig. 64.—Leather splints for diseases of the knee-joint.

early, and absolute rest is at once enforced, and maintained for the necessary period, perfect recovery, or recovery with only slight loss of movement, may, in the great majority of cases, be secured. Nothing that I have seen has left any misgiving in my mind on this subject. In many cases in which children had been lame for three or four weeks, and in which, on examination, the knee was found stiff, painful on extension, swollen, and hotter than its fellow—cases, that is, in which all the usual symptoms of tuberculous disease were well marked—perfect recovery within from six to nine months has taken place. The splints should be worn by night as well as by day, and while any active symptoms remain the limb should be scrupulously kept in the horizontal posture. Subsequently a Thomas's

knee-splint (Fig. 65) may be employed if the patient is old enough to manage crutches, and provided that no return of swelling, heat, or stiffness is, on careful watching, to be observed. In this very useful appliance the



Fig. 65.—Thomas's knee-splint in use.

weight is transmitted through the tuber ischii, and the foot does not reach the ground.

Thomas's knee-splint may be modified into a "calliper" splint (see Fig. 66) by cutting off the bottom ring and turning in the side-irons at their



Fig. 66.—Thomas's calliper splint. The weight of the body is transferred from the pelvis through the splint to the ground. No weight is borne by the knee-joint, because the heel (see dotted line) is not allowed to reach the lower end of the boot. The splint is made longer than the leg, and counterbalanced by a high boot on the sound side. The lower end of the splint fits into the heel of the boot.

lower ends so that they can be made to fit into a hollow tube in the heel. But in order that the patient may walk on the boot and yet not bear weight on the leg, the splint must be longer than the leg, so that the heel does not reach to the bottom of the boot. A V-shaped gap must be cut in the heel of the boot to prevent a sore heel. If this form of splint is used the patten on the other boot is dispensed with, provided the sole and heel are made slightly higher; nor will crutches be necessary, except perhaps at first. Considerable care is required in accurately fitting this form of Thomas's splint, and it is only suitable in quiescent cases.

In young children, however, the leather splints (Fig. 64) should be used throughout. In cases in which the joint remains irritable and sensitive, or in which there is a tendency to deformity, the leather splints may with advantage be combined with Thomas's appliance. By this arrangement the joint is completely protected, and the patient can be allowed to move about on crutches much sooner than would otherwise be advisable.

The prevention of displacement is a highly important point, for it may fairly be said of the great majority of cases that a knee-joint is not past recovery until it has been allowed to get out of shape. Even in instances of advanced disease, prolonged rest in leather splints will usually at length secure repair, as in the case of a boy, aged 9, whose history is briefly as follows: When two years of age he developed tuberculous synovitis of the left knee. For the next three years he was treated in a variety of ways. One surgeon recommended the use of leather splints to secure uninterrupted rest. These were worn for six months. Another, however, now urged the necessity of exercise to maintain the general health, and directed that the child should use the limb. Next, as the disease again increased, a bone-setter was consulted. He stated that a small

bone was out, and performed an operation to put it in. As a result, the joint became hot, considerably flexed, and enlarged, the synovial membrane was thickened, and the bones of the leg underwent displacement backwards and outwards. This, though it was distinct, was fortunately only moderate. When the disease had thus been in progress for three years, leather splints were again applied, and constantly worn, and the limb was kept in a horizontal posture. Gradual improvement took place; flexion slowly gave way to extension, and, as this change occurred, splints adapted to the improved angle of the limb were applied. Swelling, also, became less. Repair, however, was very tedious; but at the end of four years—yet not till then—the joint had assumed a natural appearance, and was freely movable; and the displacement of the bones of the leg had entirely disappeared. There was no relapse.

This gradual and spontaneous disappearance of displacement demands attention. I have met with many examples of it. It may, I think, be regarded as an illustration of the tendency of parts, during the period of active growth, to return to the normal type when the immediate effects of disease or injury have passed off. Two examples of this tendency may suffice: the spontaneous straightening of limbs deformed by rickets, and the gradual, partial or complete obliteration of scars.* This tendency in the instance before us is of great importance, and constitutes, in growing parts, a material element in the recovery that may be obtained by prolonged rest and mechanical support.

It is usually best, when a case of active disease comes under observation, not to make any immediate attempt to remove the deformity that may exist. The splints should be moulded to the joint in its present

* "Growth as an Agent in the Removal of Deformities" ("Clinical Essays and Lectures," p. 12).

position, and it will be found that, when rest takes effect, muscular spasm will gradually cease, and the limb will admit of more and more extension until it has become straight. As this alteration advances, splints of a corresponding shape must be applied. Two or three changes in the splints may thus be required. The advantage of this method is that it is gentle throughout, and that no interosseous pressure is induced. (*See* p. 517.) The objections to the practice of forcibly straightening diseased joints are stated at p. 525.

In cases of chronic disease, in which the knee has become fixed in a position of flexion, or in which flexion is combined with displacement backwards (provided backward displacement is inconsiderable), the limb may be brought into a straight position by the method of extension and counter-extension described at p. 520; the objections to the use of forcible manipulation, or of splints acting with a screw, or a rack-and-pinion movement, to secure extension, are stated at p. 522. When displacement backwards and outwards, combined with flexion, is considerable, it will be found extremely difficult, and in many cases impossible, to correct it, on account of the rigidity of the ligamentous structures at the back of the joint. This will still be the case even when the hamstring muscles have been divided. In instances of long standing a further difficulty is that the articular ends of the femur and the tibia have undergone an alteration in shape, the front part of the condyles of the femur having become overgrown so as to overhang the tibia; while the upper surface of the tibia has become oblique so as to slant downwards and backwards. In these circumstances, when extension is attempted, the bones in the fore part of the joint come firmly into contact and lock against each other; and if force, either immediate or gradual, is applied, the result is that the head of the tibia is carried back into

the popliteal space. In these unfortunate cases the only course that remains is to perform excision;* but this proceeding should be, if possible, postponed until the major part of the growth of the limb has been attained.

Charcot's disease of the knee-joint is described in Chapter XII., p. 201 *et seq.*

Syphilitic disease is discussed and illustrated by cases in Chapter V.

* See Chap. XXI.

CHAPTER XXX

DISEASES OF THE HIP

AMONG the diseases of the hip-joint are some of the gravest maladies that ever present themselves for surgical treatment. The joint is a large one, and is deeply placed beneath the great muscles of the thigh and gluteal region, while it is separated by merely a thin plate of bone, a muscle, and a layer of fascia from the cavity of the pelvis and the important organs therein contained. It is enclosed in dense and unyielding fibrous structures which give rise to a degree of tension that, in acute inflammation, greatly aggravates the processes of disease. It is subject to the influence of some of the most powerful muscles in the body, which, when they are the seat of contraction resulting from reflex nerve-irritation, induce an amount of interosseous pressure that leads to highly mischievous results. It is so formed that any material destruction of either of its component bones is liable to be followed by shifting of the articular surfaces upon each other, and a loss of the ball-and-socket mechanism on which the joint is constructed.

Until within the last few years several forms of disease of this joint were attended with prolonged suffering, and not rarely ended fatally, while, in cases in which patients survived, the limb was, in the majority, left in a deformed and crippled state. At the present time, owing to the labours of numerous workers, prominent amongst whom have been several distinguished American surgeons, and the establishment of the three

great principles of early diagnosis, complete rest, and the aseptic evacuation of matter as soon as it is detected, affections of this joint have been brought to a large degree under control; the mortality attending them has been greatly reduced, the suffering they formerly involved can now to a large extent be relieved, deformity can be prevented, or corrected if it has arisen; and in many cases recovery takes place, with complete restoration, or with very slight impairment, of the functions of the limb.

It must, however, be confessed that, while experience shows that these results are, in favourable circumstances, to be obtained, a large number of cases still end in disaster; for the three principles to which I have alluded are often not brought to bear, and cases that would, in their earlier stages, at once respond to treatment are allowed to drift on from bad to worse. This is largely due to the fact that parents, starting with preconceived notions, are unwilling to agree to the necessary means. It is also to some extent dependent on the circumstance that some surgeons are imperfectly convinced of the soundness of the methods to which allusion has been made. This subject has already been alluded to (p. 396).

ACUTE ARTHRITIS

Acute arthritis of the hip-joint is occasionally met with after an *injury*.

A boy, aged 13, while running through long grass, caught his foot, and was thrown down so that his hip was violently wrenched. He was unable to walk, and the same evening he was attacked with severe pain in the joint, and in two days his temperature rose to 103° . A long splint was applied to the sound side, and a weight of six pounds to the injured limb; but for several days pain continued to be very severe, and was aggravated

by the slightest movement. The temperature ranged between 102° and 104° , and he rapidly lost flesh. Spasmodic contraction of the muscles, producing painful startings of the limb, were at first almost constant. These were relieved when the weight was increased to nine pounds, and by the hypodermic injection of a sixth of a grain of morphia. The soft parts around the joint were the seat of effusion and brawny induration, and the glands in the groin were enlarged. On the tenth to the twelfth day suppuration seemed about to occur; but no matter could be detected. With continuous rest and weight-extension the acute symptoms gradually subsided, and at the end of three months the boy was free from pain, and his temperature had been normal for upwards of a fortnight. He ultimately recovered, but the joint was almost absolutely stiff.

Acute arthritis occurring in *pyæmia* and other forms of blood-poisoning is fortunately rare. It is in the highest degree formidable. Suppuration usually takes place rapidly, and in a few days the joint may be completely disorganised. The symptoms are, as a rule, well marked and unequivocal. The patient, in whom generally other evidences of blood-poisoning are already developed, complains of sudden and severe pains in the joint, and is unable to bear the slightest movement. The temperature ranges between 100° and 104° , and rigors may occur. On examination the limb is found to be maintained in one position; generally it is flexed, abducted and everted, and the joint is stiff. Pressure on the front of the capsule or behind the trochanter causes pain; and within a few hours there is distinct swelling, most apparent over the front of the capsule. Often, in the course of two or three days, fluctuation is detected. In other cases, however, mischief is much more insidious. The patient complains of little or no pain in the

joint, and effusion and spontaneous dislocation may take place without attracting any attention, until the altered length or position of the limb is noticed when the acute stage of the original disease has at length passed off.

In some instances a psoas abscess, connected with Pott's disease of the spine, bursts into the cavity of the hip-joint, by passing through the large bursa which lies over the front of the capsule, and which generally communicates by a wide opening with the articulation. An acute suppurative arthritis is the immediate result. Hitherto such cases have not rarely been fatal. The best course would be to drain the psoas abscess through a free incision in the loin, as recommended by Treves (p. 580), and to open the joint from the front and freely irrigate and drain its cavity. This treatment affords a good prospect of success.

In the course of *typhoid fever* the hip, more commonly, I think, than any other joint, is liable to be attacked with subacute arthritis. The affection sets in usually after the active period of the fever is over, and I have met with it when the patient had reached the sixth week after the commencement of the fever, and was far advanced in convalescence. The disease seldom goes on to suppuration, and is seldom very acute. It is characterised by pain, a fixed condition of the joint, and tenderness on pressure over the capsule. In some instances there has been considerable serous effusion, and dislocation has taken place. There is danger that this accident may be discovered only when the patient has become convalescent, and when it is too late to effect reduction. In any case in which a patient complains of pain in the joint, or in the knee, or in which the limb is observed to be fixed in one position (this is usually flexion and abduction), an examination should at once be made, and, if symptoms involving the hip are

detected, weight-extension should be applied, and a cradle should be placed over the foot to prevent pressure of the bed-clothes upon the limb.

Treatment.—In acute arthritis of the hip-joint, however produced, the limb must be placed in a position of extension, and be kept at rest by the application of a weight, or of Thomas's splint. When pain is severe these two methods may be advantageously combined. Should matter form it must be at once evacuated by free aseptic incision and drainage. In young subjects, should the joint have become disorganised, and if exhausting suppuration persists, excision or amputation may be sometimes performed, with some prospect of averting a fatal result. Generally, however, the best chance of recovery will be in prolonged rest, combined with free drainage and irrigation. In adults amputation is very seldom admissible.

ACUTE ARTHRITIS IN INFANTS

This affection, which is not rare in children under the age of two, is often obscure at its onset. The patient (usually an infant only a few months old) is observed to keep the limb in a fixed position of more or less flexion, and to cry when it has to be lifted, or when the thigh is moved. In a few hours the joint is observed to be painful and swollen. The swelling rapidly increases, so that often within forty-eight hours it has become considerable, and fluctuation can be detected.

Treatment.—If matter is evacuated early by aseptic incision, complete recovery may take place, or at most the joint may be left slightly limited in its range of movement. If, on the other hand, the nature of the case is misunderstood (I have known this condition mistaken for rapidly-growing sarcoma of the muscles of the thigh), or if there is any hesitation in opening the

abscess that has formed, matter will continue to accumulate, and, rupturing the capsule, will become extravasated among the soft structure of the thigh, the joint will undergo complete disorganisation, the head and neck of the femur and the borders of the acetabulum will be destroyed, and the upper end of the thigh-bone will be found to move freely about on the side of the pelvis. Probably death will ensue from exhaustion; but, should the patient survive, the joint will be loose and flail-like, in the condition observed in the worst examples of congenital dislocation (p. 466 *et seq.*). It will thus be seen that it is of paramount importance to let matter out with the smallest possible delay.

GONORRHOEAL ARTHRITIS

This condition involves the hip more often than any other large joint, except the knee. The affection, which may be developed at any time between four or five days and many weeks after infection, and when merely a chronic gleet remains, presents itself usually as a subacute, but very persistent, form of arthritis, attended with the same symptoms that occur in rheumatic inflammation of moderate severity. It often, after lasting for many weeks, leaves the joint completely fixed by adhesions, some of which are situated within, and some externally to, the articular cavity. In some instances, however, the attack is very sudden and acute, and the temperature rises to 102° or even 104° . Suppuration, though it has been met with, is extremely rare. Care must be taken that the real nature of the joint-affection is not overlooked; and in any case in which the symptoms of inflammation of a rheumatic type are developed in a male patient who has never before had ordinary rheumatism, it should be ascertained whether any urethral discharge (which, it should be noticed, is not necessarily gonorrhœal) is present.

The local **treatment** consists in placing the joint at complete rest; and, when the attack is acute in a strong adult, in the employment of eight or ten leeches, followed by hot fomentations frequently renewed. When the active stage of inflammation has passed, a succession of blisters about two inches square should be applied. As to the benefit derived from free blistering there can be no doubt; but in cases in which the inflammatory process becomes obstinate, the cautery has a still better effect. When inflammation has entirely subsided, and no pain has been felt in the joint for a fortnight or three weeks, should stiffness remain the patient should be put fully under chloroform, and an attempt made to restore movement by manipulation, by first flexing the limb, then adducting it, then abducting it, and lastly extending it. In a strong subject in the prime of life considerable force may be used; but this must always be applied cautiously, and not too suddenly. I have seen the end in view defeated by the use of violence, which had the effect of producing extensive laceration of the muscles, and a further exudation of lymph about the joint, which became organised and added to the stiffness already present. In many cases manipulation fails to restore motion, for, though the joint moves freely at the time, stiffness quickly returns. In such instances daily massage and passive movements must be practised, and be continued for several weeks. In some instances complete bony ankylosis is developed. Should the limb have become firmly fixed in a distorted position, which manipulation fails to correct, the case must be treated as one of ankylosis, and either the neck of the femur must be divided by Adams's method, or (as I myself prefer) by a chisel introduced through a posterior incision, or else osteotomy below the trochanters must be performed.

OSTEO-ARTHRITIS (MORBUS COXÆ SENILIS)

This condition is much more common after than before the age of 40. It may originate in direct violence from a fall or other injury, but often it appears to be spontaneous. In the absence of recent injury, careful inquiry may elicit a history of injury or disease in earlier life, with subsequent recovery. The fact that this form of disease is usually confined to one joint, and is most often met with in men, who are more prone to injuries and sprains of the hip than women, confirms the view that injury is an important though not an invariable factor in determining the onset. The condition used to be spoken of as absorption of the neck of the femur. This name is inappropriate and misleading, for the changes that ensue are in every respect identical with those of osteo-arthritis arising in cases in which no injury has taken place. The acetabulum becomes enlarged, and surrounded by irregular formations of new bone; and the appearances observed in the femur are due—not, as may seem on a casual inspection, to absorption of the neck, so that this part is primarily shortened, but—to melting away of the prominence of the head, and to the formation of new bone around its base and encroaching upon the neck. In these cases, in which the head appears to rest on the shaft without the intervention of a neck, the original head and the greater part of the neck have been completely lost, and the apparent head is in reality the base of the neck surrounded by a mushroom-like expansion of new bone. This form of osteo-arthritis, though met with chiefly in elderly people, most commonly in men, may develop in middle or even in early life. Thus Gulliver * records examples of it in subjects, all being males, of the respective ages of 15, 19, 30, 32, and 45. It is probable that many of these cases, observed

* *Edin. Med. and Surg. Journ.*, xlv. 97, 312.

prior to the introduction of X-rays in young people, were cases of adolescent coxa vara following on traumatic separation of the epiphysis (*see* Chapter XXXII.).

The affection, though sometimes ensuing very slowly, often reaches a stage in which all its features are well marked in the course of a few weeks—so rapidly, indeed, as to give rise to the belief that the patient is suffering from fracture of the neck of the femur which has been overlooked. The following is a typical example:—

A lady, aged 52, fell heavily upon her left trochanter as she was joining in the fun and romp of a children's party. Although conscious of a severe bruise of the hip, she moved about during the remainder of the evening, and went up and down stairs without assistance. During the next three days she still went about, though with gradually increasing pain and lameness. She was then obliged to remain in bed. Pain about the hip was so severe that she could obtain but little sleep, and the joint became stiff and the hip markedly tender. Two months later the limb was an inch and a half shorter than its fellow, and everted; the trochanter was much less prominent than natural, and considerably above Nélaton's line; movement of the joint was very limited, and attended with great suffering and with distinct grating. That this was a case of osteo-arthritis, and not of fracture, was clearly proved by the fact that for two days after the accident the patient was able to go up and down stairs without help, and that the symptoms gradually increased in intensity, having at first been those simply of a severe bruise. These cases are important, not only in themselves on account of the circumstance that they may give rise to the belief that a fracture has been overlooked, but as illustrating the fact that one of the causes of osteo-arthritis is an injury which at the time may seem to be unimportant.

The first symptoms, here as in other varieties of osteo-arthritis, are stiffness and pain, often severe and wandering through the limb, darting through the glutei or the muscles of the thigh, or taking the form of sciatica. That sciatica may be produced by osteo-arthritis should not be forgotten, and in cases of obstinate sciatica a radiogram should always be taken of the hip-joint.

Wasting soon becomes marked, the gluteal region is flattened, and the muscles of the thigh are shrunk and flabby. The knee-jerk on the affected side is usually exaggerated. Motion is gradually lost, so that the pelvis rocks when the thigh is flexed, and rotation of the femur in the acetabulum is lost. The thigh either remains extended on the trunk or acquires some degree of flexion, which shows itself as lordosis (p. 432). The limb, however, undergoes shortening (the result of absorption of the head of the femur and the upper border of the acetabulum), and rotation outwards, while it also becomes somewhat adducted. In these circumstances the patient becomes much crippled, and finds it especially difficult to go up or down stairs, to mount a horse, or to rise from a low seat. On examination, in addition to the symptoms already mentioned, it is found that the upper end of the femur is enlarged, and that the trochanter is lying distinctly, often considerably, above Nélaton's line, while, if movement is still present, grating or creaking can usually be detected. Occasionally, though rarely, both hips are involved, and in some instances osteo-arthritic bony outgrowths are met with surrounding the acetabulum and head of the femur, after the disease has been in existence for some years. Cysts may occasionally form in connection with the joint.

A striking deformity which occasionally results from osteo-arthritis of the hip is shown in Fig. 67. In this



Fig. 67.—Attitude in cross-legged progression.

patient both hip-joints in the course of osteo-arthritis had become fixed in a position of adduction combined with extension. A like deformity has been met with in cases of double hip-disease. The method of walking adopted by patients with this distortion has been termed "cross-legged progression."

Treatment.—The general treatment of osteo-arthritis is described at p. 162. In the hip, as in the other joints, gentle exercise is advisable. When the joint is painful, counter-irritation in the form of mustard-leaves or small blisters gives marked relief in many instances. In some cases, however, it completely fails. Blisters act best when they are used in a series of four or five, one being allowed to heal before the next is applied. In some instances pain is relieved by the continuous electric current of six or eight cells applied daily. In the later stages the disease obstinately resists treatment, and often steadily advances. When able to do so, the patient should go to one of the health resorts alluded to in Chapter IX., and take a course of baths and douches. Little can be done but to employ the means that have been enumerated for the relief of pain, and to advise the patient to walk with a firm stick, so as to avoid throwing much weight on the joint, and to wear a high boot, constructed as lightly as possible, which will compensate for shortening of the limb.

The question of endeavouring to restore movement, when the joint is stiff, is one of great importance. As a general rule, no advantage will be obtained by such an attempt; while there is considerable danger that the force employed may be followed by aggravation of the patient's suffering. In a few instances, however, the range of movement may be increased by the detachment and displacement of some of the adventitious bone which has become deposited around the margin of the articulation, and which by a slight degree of force can

be pushed aside. The cases where manipulation may fairly be tried are those (1) in which the patient is not beyond middle age, and is strong and in good general health, (2) in which the disease is progressing slowly and only the hip is affected, and (3) in which the joint, without being the seat of much pain, is so stiff as to be a source of great inconvenience. The attempt should certainly not be made in old and feeble patients in whom many joints are affected, or in those who are suffering considerable pain.

When the disease is obviously making active progress, and is, moreover, attended with pain which is increased by exercise, marked benefit will be obtained by keeping the patient in bed for a few weeks and applying weight-extension. This treatment is necessary, for the pain felt on movement, the spasmodic jumping of the limb, and the rapid absorption of the opposed articular surfaces, all show that the muscles around the joint are the seat of reflex irritation leading to interosseous pressure, to which the persistence of pain is largely due. In this form of the disease, counter-irritation, produced either by blisters, or by the actual cautery lightly applied, is also indicated. It must, however, be cautiously resorted to in elderly or enfeebled subjects. Although such treatment is not generally regarded as appropriate, I have met with several instances in which it has been attended with very satisfactory results.

In some cases associated with severe sciatica, excision of the head of the femur has been practised for the relief of the excruciating pain. This measure should only be adopted as a last resort, and is not to be recommended as a method of treatment for relief of the joint-disease.

CHARCOT'S DISEASE

Next to the knee, the hip is, among the large joints, most liable to be attacked by this affection. In some

instances the local features of the malady are indistinguishable from those of osteo-arthritis of the ordinary type, and it is only the presence of tabetic symptoms (p. 200) that discloses the more formidable nature of the attack. In other cases, however, the changes in the joint are not only associated with evidences of disease in the spinal cord, but they exceed, both in the rapidity with which they are developed and in their extent, anything with which we are familiar in the course of what is usually understood as osteo-arthritis. These cases also differ notably from osteo-arthritis in the absence of pain and, generally, of stiffness, in the fact that the patient is able to make considerable use of the limb, and in the presence, in some of them, of a large collection of turbid serum forming a fluctuating tumour occupying Searpa's triangle, and presenting also at the outer and back part of the joint.

As to **treatment**, there is generally but little to be done. In those instances in which there is a distinct history of syphilis, especially if this is recent, either mercury or iodide of potassium should be given. Cod-liver oil may be tried, and is sometimes beneficial. If large collections of fluid are present around the joint, they may, if the amount is increasing, be aspirated aseptically, though it is doubtful whether anything material will be gained by the proceeding, for the fluid will probably soon re-form. Cases have been recorded to show that rest has a marked influence in checking the progress of the disease in acute cases, so far as the wearing down and destruction of bone are concerned.

TUBERCULOUS DISEASE OF THE HIP (MORBUS COXÆ, MORBUS COXARIUS)

Hip-disease, in the natural sense of the word, is as vague a term as "eye-disease" or "lung-disease" would be. The phrase, however, which has come down to us

from former times, is now by common usage limited to tuberculosis of the joint. Nor, when thus employed, is it superfluous; for the malady in question presents so many special features in respect alike to its symptoms and diagnosis, the course it takes, and the treatment it requires, that it is convenient to describe it under a separate name.

Hip-disease usually originates in the bones—either in the upper end of the femur, or in the floor of the acetabulum; but it may also begin, though this is comparatively rare, in the synovial membrane. The old view, that it commenced in the ligamentum teres, or in the articular cartilage, has long been discarded.



Fig. 68.—Separation of the epiphyseal head of the femur.

(From a specimen, No. 621, in St. Bartholomew's Hosp. Mus.)

In the femur, tubercle is deposited (a) in the growing tissue of the neck, immediately beneath the epiphyseal plate (Fig. 68); (b) in the substance of the head, in the vicinity of the ossifying nucleus; or (c) in some part of the neck within the capsule. In the acetabulum it usually affects the lines of junction between the three

segments of bone which meet here, and are connected, during growth, by the Y-shaped cartilage. The frequency with which the hip-joint becomes involved in tuberculosis seems to depend on the fact that both the upper end of the femur and the floor of the acetabulum are formed of vascular cancellous bone which is undergoing rapid growth. It is in such a tissue that the tubercle-bacillus finds a highly congenial soil. While the disease at its commencement is a lesion of the osseous system, the joint becomes involved as a direct result of the anatomical relation of the parts. For, as the area of the bone-mischief is enclosed within the capsule, the synovial membrane becomes infected by direct extension. This extension of inflammation from the bone to the synovial membrane is generally a gradual and insidious process. In some instances, however, inflammatory products, originally contained within the bone, suddenly escape from its interior into the cavity of the joint, with the result that an acute synovitis, soon converted into an acute suppurative arthritis, attended with severe pain, high temperature, and other urgent symptoms, is produced. In other instances, tuberculosis of the upper end of the femur leads to chronic osteitis of a low grade of intensity, accompanied by considerable and irregular enlargement of the bone, with the result that, while the symptoms of joint-disease are but slight, so much heaping up of new bone occurs about the upper end of the femur as even to suggest the presence of sarcoma.

In the synovial variety the inflammatory process may be acute, and attended with early suppuration; but much more commonly it is chronic, and leads either to slow caseation and suppuration, or, when the effused lymph is plastic in its character, to firm fibrous or, more rarely, bony ankylosis.

Whatever its starting-point, the disease, if allowed

to advance, soon involves all the structures of the joint. Owing to the cancellous structure of the bones, the inflammatory process commonly ends in caries, rather than necrosis; and though sequestra are sometimes found, they are seldom much larger than a nut, and consist of soft fragments easily broken down and absorbed. Cases, however, are not very rare in which, as the result of acute inflammation at the junction of the epiphysis with the neck, the whole head of the femur, or what remains of it, becomes detached from the neck (Fig. 68), and is found lying in the interior of an abscess, or in the cavity of the joint. In extensive disease of the acetabulum, sequestra may be found, but they are usually small and friable. Ultimately, the head and neck of the femur, as well as the rim of the acetabulum, having been absorbed, the upper end of the femur is displaced upwards and backwards on the dorsum ilii, and accompanying this displacement there is usually an increase of deformity in the direction of flexion and adduction of the limb. In the worst cases the bones become extensively involved. Chronic osteo-myelitis spreads down to a considerable distance along the medullary tissue of the femur, and leads to widespread necrosis. In other instances, the rim of the acetabulum becomes so extensively absorbed that the cavity is entirely destroyed.

Diagnosis.—Although in advanced cases hip-disease is often obvious almost at a glance, yet in its incipient stage, in which its recognition is so highly important, an accurate diagnosis is often attended with considerable difficulty. In such instances it can be arrived at, not by an appeal to two or three symptoms that are always well marked, but by taking into account and fitting together various symptoms, no one of which, if isolated from the rest, would be of any material diagnostic value.

Symptoms.—It is not possible to place the different symptoms in the order of their relative value; the following is a mere enumeration of them as they would be most conveniently observed in the investigation of a suspected case. They are—1, lameness; 2, pain; 3, abnormal posture; 4, alteration in the length of the limb; 5, loss of movement; 6, muscular wasting; 7, swelling about the joint. Each symptom claims a brief notice.

1. *Lameness.*—Generally a patient with incipient hip disease is lame, often very markedly so; but sometimes only to the degree of a very slight limp which may easily escape detection. And his lameness may vary with circumstances. When he has been at rest it may completely disappear, but it becomes marked after exercise. Sometimes it may at first be entirely absent for a week or even longer, so that the history shows periods of lameness alternating with intervals in which the symptom completely passed off. In such cases lameness is apt to be ascribed to a slight attack of rheumatism, or to “growing pains.” I remember several children who, having become lame, were at once put to bed and kept there for three or four days before being brought for examination, and in whom the lameness had subsided, though other symptoms clearly indicated that early hip-disease was in progress. This will be further dealt with later. Again, it must always be remembered that there is no form of lameness that is in the least characteristic of or special to hip-disease.

Lameness may be due to four different causes—impaired movement in the joint; altered position (flexion, abduction or adduction) of the limb; tenderness of the structures involved; and the weakened condition of the surrounding muscles. And its form will vary with each of these; or, rather, will depend on the manner in which they happen to be combined.

Obviously, for example, lameness depending on marked flexion will not be the same as that due to tenderness of the joint, in a case in which the limb is abducted and only slightly flexed. Nor must it be forgotten that lameness which at first suggests hip-disease may be produced by some altogether different cause; for instance, by spinal disease and psoas abscess, or even, as I once saw it, by a contracted burn-scar on the groin.

Thus it will be seen that, although lameness is clear evidence of the presence of some abnormal condition, it is of no direct value as a means of diagnosis between hip-disease and some other affection from which the patient may be suffering. In other words, it is an indication that there is something wrong; but, taken alone, it carries the investigator no farther; what the wrong is must be determined by an appeal to other evidence.

2. *Pain* varies greatly in its amount. It may even be entirely absent. In some cases, from first to last, it is so slight as to be misleading. In others it is severe and persistent. The following is the nerve supply to the hip-joint: branches from the anterior crural usually, but not constantly, pierce the front of the capsule; some from the sciatic and other offsets of the sacral plexus enter behind; and a twig from the obturator reaches the interior through the cotyloid notch. From these different sources peripheral branches are supplied to various parts of the limb below. Branches from the anterior crural enter the knee through the front, and from the obturator through the back of the capsule; other twigs from the obturator end on the inner side of the thigh, while the sciatic supplies the ham, and the long saphenous the inner side of the leg. This nerve-distribution is alluded to in order to explain how it is that pain may be felt either in the hip-joint itself, or in and about the knee, on the inner side of the thigh, or the inner aspect of the leg. Its occurrence in parts of the

limb below the hip is an example of the reference of pain to the peripheral ends of the sensory nerves.

It is well known that when the hip is affected pain may be so entirely confined to the knee as to lead to an oversight as to the real situation of the disease. A case was lately brought from India for treatment in England, in which both knees had been assiduously blistered for pain which in reality depended upon double hip-disease. Pain referred to the inner side of the thigh or the leg is not very commonly met with, yet distinct examples of it are now and then to be seen. It must be remembered that pain is occasionally referred to the knee and other parts of the limb in several affections besides disease of the hip—in Pott's disease of the lumbar spine, inflammation of the sacro-iliac joint, and abscess in the pelvis or in Scarpa's triangle—so that this symptom is of itself in no way conclusive as to the presence of disease of the hip. It becomes valuable only when it is found combined with other signs. The severe pain which recurs whenever the patient drops off to sleep, and which leads to night-screams, is produced by the sudden pressing together of the articular surfaces during contraction of the muscles round the joint, resulting from reflex irritation.

3. *Altered position*.—In the early stage of the disease the limb is flexed, abducted, and rotated outwards. The explanation of this attitude, formerly so much discussed, is simply that it is the position of greatest ease. It is habitually assumed when we sit at rest with the lower limbs flexed, the knees apart, and the heels nearly touching. Flexion relaxes the strong ilio-femoral ligament in front of the joint; abduction, the ligamentum teres and the upper (ilio-trochanteric) band of the ilio-femoral ligament; and rotation outwards, the inner band of the ilio-femoral ligament and the back of the capsule.

The deformities which develop in hip-disease are readily understood with the help of the cardboard models, Figs. 69 to 72B, contrived and kindly presented to the author by Dr. J. Ridlon, of Chicago.

Fig. 69 shows the pelvis in the normal (horizontal) position and the two limbs parallel. In Fig. 70 the limb has become abducted, and fixed (in the model, by a clip applied at A). Fig. 70A represents the limb restored to a parallel position with its fellow. This change has been effected by the drawing up of the pelvis on the opposite (sound) side at B. In life this drawing-up is performed by muscles passing from the thorax down to the pelvis. It is obvious that when the pelvis is drawn up at B its corresponding point at C will be depressed, and that this will involve the movement of the limb inwards towards the middle line. This also involves the production of "apparent lengthening," for when the pelvis is made to descend on one side it necessarily causes the limb on that side to protrude downwards to a like degree. Thus apparent lengthening always indicates abduction. Moreover, the pelvis can at once be restored to the normal position (so that the anterior iliac spines are in the same horizontal line) by abducting the limb. In Fig. 71 the limb is shown in the adducted position which it occupies in the later stage of hip-disease—a position which renders walking very embarrassing. The patient can bring the affected limb into a position parallel with its fellow by drawing up the pelvis on the diseased side, as in Fig. 71A. This movement obviously involves the production of apparent shortening. Thus, apparent shortening always means that adduction is present.

Fig. 72 shows the natural position of extension of the limb on the trunk. In Fig. 72A the limb has become flexed on the trunk, and fixed by muscular rigidity (imitated in the model by the clip A). In Fig. 72B, by

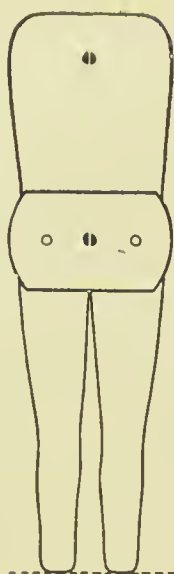


Fig. 69.

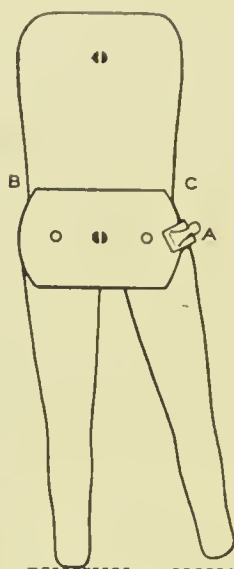


Fig. 70.

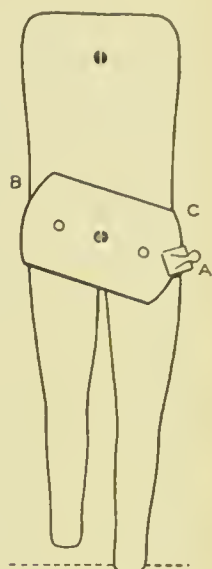


Fig. 70A.

curvature of the lumbar spine forwards (lordosis), the pelvis has been rotated on its transverse axis, and

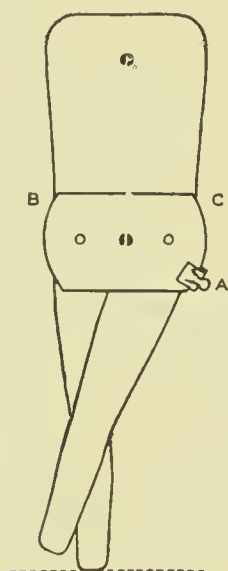


Fig. 71.

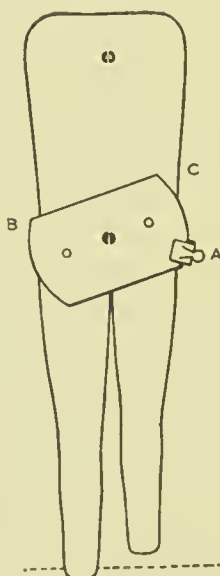


Fig. 71A.

the limb brought down into a line with the trunk. It is thus seen that lordosis is the compensatory position for flexion of the limb on the trunk—a position, that is, which the patient assumes in order that he may place his limb in an attitude of quasi-extension and be able to walk upon it.

4. A real *alteration of length* of the limb occurs only in the direction of shortening. True lengthening, if not

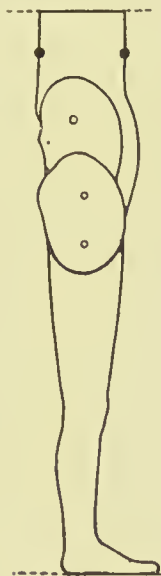


Fig. 72.

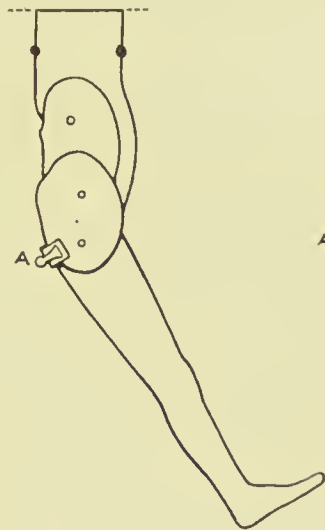


Fig. 72A.

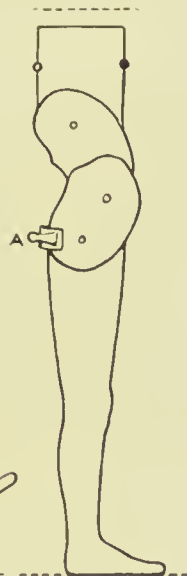


Fig. 72B.

absolutely non-existent, is rare in the highest degree, and its seeming existence on measurement depends on an error in the way in which the measurement has been taken. Real shortening results either from bone-absorption, or from arrested growth of the limb, or from pathological dislocation—i.e. the sudden or gradual slipping of the femur upwards upon the dorsum ilii, after the head of the bone and the upper rim of the acetabulum have been in part or entirely absorbed.

Real shortening from absorption of the head of the femur and the upper part of the acetabulum is present

only when the disease has considerably advanced. Its amount may be tested either by a careful comparison of the position of the trochanter on the suspected side with that on the sound side, by placing the thumbs on the anterior iliac spines and the fingers on the tops of the trochanters; or by drawing Nélaton's line (from the anterior iliac spine to the *most prominent* part of the tuber ischii), and then observing whether the trochanter touches though it remains below this line, as is normally the case, or whether, and to what extent, it passes above it.

5. *Impaired movement.*—This is in all but exceptional cases the most important of the symptoms of early hip-disease. There are possible fallacies, however, in connection with it that require to be recognised and guarded against. In applying this test, all the movements natural to the joint must be severally and critically investigated. It is a useful preliminary to move the sound limb slowly through all its natural ranges, so that the patient may see that manipulation is to be gentle, and understand (if he is old enough) what is intended in regard to the suspected limb. The thigh on the side in question—being held just above the knee, and the leg being flexed—should be a little drawn upon, so that the head of the femur is not pressed home into the acetabulum, and the limb should be slowly, and with a light touch, flexed upon the trunk; but it is very important that it should be at the same time adducted, so that the knee is carried upwards and across the middle line. The point here is that the limb (if disease is present) is probably already fixed in a position of abduction, and will therefore admit of considerable flexion and abduction combined; whereas flexion combined with an attempt at adduction at once discloses that movement is restricted. This flexion, with adduction, must be carried to its full normal range, for in some

early cases the limb will move with unimpaired freedom through all the middle range, and it is only when the limit of normal movement is approached that restricted limitation can be detected. During this movement of the limb, the surgeon's disengaged hand should be placed under the lumbar spine, so as to make sure that movement is not being produced there instead of at the hip-joint. It should then be ascertained—the spine being watched as before—whether the limb can be completely extended; and then whether, when flexed at a right angle with the trunk, it can be completely abducted and completely adducted without disturbing the pelvis, or whether when a certain point is reached the pelvis follows the femur.

These tests are often all that are employed as to movement, but, thus used, they may be completely deceptive and may be productive of grave mistakes. What they serve to show is, whether or not the thigh moves with its natural freedom upon the trunk; but it is highly necessary to bear in mind that they show no more than this. They afford no trustworthy evidence whatever upon the crucial question whether the stiffness is produced within the joint itself, the case being one of hip-disease; or by the condition of the surrounding parts, the joint^o itself being perfectly healthy. Fortunately, another test-movement remains which may be trusted, except in very rare cases, to settle this point. This is the movement of rotation. To apply it, the thigh is placed at an angle of about 100° with the trunk; the knee is lightly grasped, and an attempt is then made to rotate the femur on its long axis in the cup of the acetabulum. If rotation is perfectly free, it goes far to negative the presence of disease. If, however, rotation is more or less interfered with, this shows that disease is really present. But where is it situated? It is at this point that rotation becomes so valuable for differential

diagnosis. If the joint itself is affected, rotation is lost or much impeded, even through a narrow arc; while, on the other hand, if the joint itself is healthy and is merely hampered in its movements by the condition of the surrounding parts, although rotation is much impeded or entirely lost in the wider ranges, it is, within narrow limits, absolutely free, and the head of the bone can be felt moving with its normal smoothness and facility in the acetabulum.

There are, it is needless to say, several conditions of the parts surrounding the joint which interfere with either flexion or extension, or with both, and which may thus be mistaken for hip-disease unless the rotation test is critically applied. There may be (a) Pott's disease of the spine attended with an iliac or psoas abscess. Here there may be flexion (or lordosis), abduction (or apparent lengthening), and eversion; there may be pain in the knee and marked muscular wasting, and, when an attempt is made to extend the limb, it may be found that lordosis is being produced or increased: in other words, that extension cannot be effected. The test of rotation, however, when the limb is flexed at an angle of about 100° with the trunk, discloses the fact that movement of the joint itself is perfectly free, a fact that should at once direct attention to the condition of the parts outside the joint, with the result that the abscess will be detected, and the true state of the case made out. There may be (b) Pott's disease with subgluteal abscess. Here, as soon as an attempt is made to flex and adduct the limb, the pelvis will be carried up with the thigh, just as it is in hip-disease. The rotation test will, however, at once show that the hip-joint itself is not affected.

Although the subject now under discussion is the diagnosis of early hip-disease, I may, in passing, refer to the great value of the rotation test in a set of cases in

which disease is of long standing. There may be considerable brawny thickening and swelling about the hip-joint with matting of the soft parts, together with several sinuses occupying the usual positions of sinuses depending on hip-disease—on the outer side beneath the tensor fasciæ femoris; behind the trochanter; or just above Poupert's ligament; and it may be found that, tested as to flexion, extension, abduction, and adduction, the movements of the joint are lost. Here an error is likely to be committed unless the rotation test is applied. When this test is appealed to, it may be found that within certain limits the smooth head moves normally in what the trained sense of touch easily appreciates as a normal acetabulum; and now on examining the spine the evidences of disease in that structure will be detected. Even mere external adhesions following a wrench may imitate disease of the hip.

6. *Muscular wasting* is a very constant and important symptom. It is most marked as flattening of the glutei and obliteration of the gluteal fold; but it can also be detected, with less annoyance to female patients past early childhood, by comparing the circumference of the middle of the thigh with that at the same level (arrived at by careful measurement) of the opposite limb. But it is obvious that although muscular wasting is a constant symptom of established hip-disease, its existence may be due to so many other causes—for instance, to infantile paralysis, congenital dislocation of the hip, disease of the lumbar spine (I have several times met with wasting of one of the lower limbs from this cause), sacro-iliac disease, or disease of the sacrum involving the branches of the sacral plexus as they leave the sacral foramina or the sacro-sciatic notch—that it must be said of muscular wasting, as has been said above of lameness, that it is not in itself in any way pathognomonic of hip-disease. In combination with other symptoms, it

is of first-rate value ; but apart from them its meaning is entirely inconclusive. Muscular wasting is frequently ascribed to disuse of the limb. It is, however, though in part due to this cause, produced mainly by reflex atrophy, and has its counterpart in the muscular wasting which accompanies disease of all the other principal joints.

7. *Swelling*.—Although swelling is a very early and valuable symptom of tuberculous disease of the superficial joints—elbow, wrist, knee, ankle—it is not usually to be detected in early hip-disease, for it is masked by the thick coverings of the joint. It may, however, sometimes be made out as a fullness over the front of the capsule in Scarpa's triangle ; or it may be due to enlarged glands in the line of Poupart's ligament. Swelling may also be discovered by grasping the joint between the finger, placed in front of the capsule, and the thumb, placed behind the trochanter. Sometimes important evidence may thus be obtained that the upper end of the femur is involved in the inflammatory process. General swelling around the joint, in the early stage, is occasionally seen, and must be regarded as a formidable symptom, indicating widespread and rapidly advancing tuberculous infection of the tissues, which will probably be followed by extensive suppuration. Should a high temperature also be present the severity of the case would be all the more clearly indicated. The absence of swelling, it must be understood, does not in the smallest degree indicate that hip-disease is not present.

Here I may particularly allude to the extent to which the symptoms of incipient hip-disease may disappear when the joint has been kept at rest for a few days. This is shown by the following cases, and the fact is one of great clinical importance. A highly distinguished surgeon expressed the opinion that a boy of 9 had early hip-disease, and advised that he should be at once confined to the horizontal position. After the boy had

been kept in bed a fortnight his parents decided to see someone else, and consulted a surgeon scarcely less distinguished than the first. This surgeon said that no disease was present. Feeling all at sea, the patients requested me to examine the child, but without stating what had already taken place. I found the patient in bed. The movements of the joint were absolutely free in every direction, except that abduction seemed to be very slightly restricted; there was apparent lengthening, so slight, however, that it was scarcely appreciable; and the glutei were in a very slight degree wasted and flabby. The child, when asked to get out of bed, did so very readily, and walked without a trace of lameness; and he had no pain whatever. As there were three symptoms obviously present, though they were almost imperceptible, I reported that a suspicion of hip-disease must be entertained. I was then told the previous part of the case, and, on inquiring of the first surgeon consulted, was informed that when he saw the child (a fortnight before) the patient was distinctly lame, and was complaining of pain in the hip and in the knee; whilst flexion, abduction, and rotation were restrained to a degree that was quite unmistakable. The view that hip-disease was present was confirmed by the subsequent history of the case.

A child, aged 6, was brought to the out-patient room for advice as to pain in the knee and lameness—for which she had, however, been kept in bed for a week, during which time the pain had disappeared. I carefully examined the case. The glutei muscles were a little flabby on the suspected side, and there was very slight apparent lengthening: but I could not detect the slightest restriction of movement; the child did not complain of pain, and she walked without appreciable lameness. Feeling suspicious, but yet uncertain, I desired the mother to let the child be on her feet for

three or four days, and then to bring her again. Three days later she returned. The child was now distinctly lame, pain had returned, and on examination I found the hip so fixed that one of the dressers, when asked what was the nature of the case, said there was evidently, on whatever it might depend, firm ankylosis of the hip.

Examination.—During examination the patient should be undressed, and lie, not on a soft bed, but on some firm surface—a well-stuffed couch, a table covered with a folded blanket, or the like. It must then be observed whether he can lie flat on his back in the normal position, with the lumbar spine free from forward curvature (lordosis) and the ham touching the couch; whether the malleoli correspond, and whether the anterior iliac spines are level. If, while the knee is down on the couch, the lumbar spine is felt to be arched forwards when the fingers are passed under the loins, it shows that the thigh is flexed on the pelvis; the extent of this flexion is ascertained by raising the knee until the lumbar spine is straight. If the anterior iliac spine of the suspected side is too low, it means that the limb is abducted (p. 422); the amount of abduction is ascertained by moving the limb outwards until the iliac spines are level. If the anterior iliac spine, on the contrary, is too high, it indicates adduction (p. 422), the degree of which may be defined by moving the limb inwards across its fellow until the pelvis is again square. Thus the real position of the limb on the trunk will be disclosed. Movement should now be tested by carrying the thigh, with the knee a little bent, slowly and gently in the direction, first of flexion (the knee being carried upwards and inwards across the middle line) to the full natural range; secondly, it should be extended, also to the full amount, the hand being placed under the loins to see that no lordosis is being produced; thirdly, the knee, still flexed, should be gently grasped, and while the

fingers are placed on the anterior iliac spine the thigh should be carefully rotated, so as to ascertain whether the femur turns freely in the acetabulum. This test, as already said, is of the highest value, and must be very carefully applied by light and gentle manipulation of the limb, so that neither is the child frightened nor are the muscles roused to a protective contraction. The movements in all directions must be carried to their full range, for in slight cases it is only as their extremes are approached that they are limited, and so afford evidence of disease.

Muscular wasting should now be looked for by comparing the two hips, as to flattening and flabbiness of the muscles and the loss of the gluteal fold (p.427); or the same information may be gained by taking the circumference of the two thighs at the same level, the corresponding points being obtained by measuring upwards from the superior edges of the two patellæ. Any swelling that exists may be detected, either by comparing the two sides, or by careful handling. It should especially be noticed whether any thickening is felt when the joint is grasped between the fingers and thumb in a direction from before backwards. Tenderness on pressure, either over the front of the capsule or behind the trochanter, is sometimes a marked symptom, and much depended on by some surgeons. It should be carefully used, for children often complain from the mere fear of being hurt. Jarring the heel or the knee is also a test little to be trusted in any case of doubt. It makes a timid child flinch although the joint is sound, and certainly it often gives no discomfort when the joint is undoubtedly affected. When the disease has commenced in the bones or has extended to the articular surfaces from the synovial membrane, a comparison between radiograms taken of the two sides will often afford valuable assistance.

When all these symptoms have been investigated the evidence must be carefully weighed. Generally a conclusion is readily formed, but in some cases this is a matter of no small difficulty, and a diagnosis can be arrived at only by piecing together various small shreds of evidence, and in spite of the absence of symptoms which are usually well marked. Thus in one case the only symptoms may be slight and occasional pain, either in the knee or the hip, slight flattening of the glutei or a flabby condition of the muscles of the thigh, slight impairment of rotation of the femur in the acetabulum, and slight thickening over the front of the capsule. In another, while there is scarcely a trace of pain, slight lordosis, slight apparent lengthening, and slight limitation of extension and rotation can be detected. In still another, the only prominent symptom may be muscular wasting, so marked as to suggest infantile paralysis, though a careful examination shows impaired movement, and perhaps tenderness on pressure over the front or the back of the joint. An important point in diagnosis is the exclusion of disease elsewhere, especially in the spine and the sacro-iliac joint. Errors are likely to occur in the direction either of overlooking incipient disease, or of a confusion between hip-disease and disease of the spine attended with psoas or iliac abscess; congenital dislocation of the hip-joint—a much more common condition than some believe; coxa vara; infantile paralysis; and the lordosis of rickets, accompanied, as is sometimes the case, with a painful condition of the muscles of the limbs. In one case infantile scurvy, attended with hæmorrhage under the periosteum of the upper end of the shaft of the femur, and pain on movement, was at first mistaken for acute hip-disease.

Results.—If the disease be allowed to progress unchecked, various serious results are soon developed.

1. *Deformity*.—This arises chiefly from muscular action, the result of reflex irritation. The limb at first becomes gradually more flexed and abducted—forms of distortion showing themselves as the patient lies in bed, as lordosis, and obliquity of the pelvis, with apparent lengthening of the limb (p. 422). Afterwards there is flexion combined with adduction, as the result of which the pelvis on the diseased side is more and more drawn up, so that there is an increase of apparent shortening. By degrees, also, as the bones are absorbed, the trochanter travels upwards and backwards on the ilium, and considerable real shortening is produced.

2. *Abscess*.—When hip-disease is seen early (in the first three or four months), and is adequately treated, suppuration does not occur in more than 10 or, at the most, 15 per cent. of the total number of cases. At this stage treatment leads to the subsidence of inflammation and the absorption of exudation; and the bacillus, thus deprived of a favourable pabulum, is placed at a fatal disadvantage. The tuberculous process gradually ceases, its products are disintegrated and removed, and the tissues undergo sound repair. But if the disease is left to advance, cascation and suppuration will probably follow. Yet even in advanced disease suppuration does not always take place. Every surgeon has met with cases of long-standing hip-disease in which, although extensive bone-absorption has occurred, indicated by displacement of the trochanter, much bony thickening has taken place about the upper end of the femur, and the movements of the joint are lost, yet no abscess has formed.

In such cases the tuberculous process, though persistent, is of low intensity, so that the resulting inflammation, instead of being active and destructive, is attended with the organisation of new material, leading to sclerosis of bone; and to a cicatricial condition of

the soft parts, very similar to that which is present in fibroid phthisis.

In a small proportion of cases the tuberculous process is active from its beginning, and suppuration occurs notwithstanding careful treatment. If, in these instances of early suppuration, septic elements gain an entrance from without, either when the abscess is opened or at any later period, death by exhaustion will very probably ensue, perhaps after suppuration has continued for several months. Many abscesses are developed insidiously, but others are preceded by long periods of raised temperature, night-screaming, and pain on movement. Many form within the joint, and travel outwards, either through the cotyloid notch, to present in Scarpa's triangle; or through the thin part of the capsule at the back of the neck of the femur, to lie beneath the glutei; or they may pass into the bursa under the tendon of the ilio-psoas, so as to be situated in front of the joint, close beneath Poupart's ligament. Others are from the first outside the capsule, and arise from suppuration about the inflammatory products with which the soft parts have become infiltrated. These may be present at any aspect of the joint, and they often make their way for some distance beneath the tensor fasciæ femoris, or towards the apex of Scarpa's triangle. When the acetabulum is affected, matter may form within the joint, and, after producing absorption of the bone, may cause a collection on the inner aspect of the pelvis beneath the obturator fascia, or it may form here when, although involved, the acetabulum is not yet perforated.

Such abscesses, even when small, may sometimes be detected by a finger passed into the rectum, a method of examination which on occasion affords useful information. As they increase, these collections within the pelvis, rising in the direction of Poupart's ligament,

can at length be felt when the fingers are pressed downwards above the ligament towards the deeper part of the pelvic cavity.

Several cases have come under observation in which intrapelvic abscesses have formed a connection with the rectum and bladder, so that fæces and urine made their way through the hip-joint and were discharged by sinuses opening on the surface. In a case recently met with, suppuration within the pelvis was followed by extensive necrosis of the sacrum.

The detection of an abscess is usually easy. When two or three fingers are placed flat on the surface, and are made to pass over the different aspects of the joint, a circumscribed swelling is found, in which fluctuation can be discovered. When matter is but small in quantity, and is deeply placed, it may be difficult to find it: there may be no fluctuation, and, as the abscess is chronic, neither œdema of the surface nor the "tender spot" (often such important symptoms in deep-seated acute abscess) is present. In such a case the discovery of deeply placed resistance, of fullness, or of elasticity will raise a suspicion of the presence of matter; and the abscess, as it increases, will soon distinctly declare itself by the development of fluctuation.

Abscess may occur in any of the following situations—beneath the tensor fasciæ femoris, in any part of Scarpa's triangle, posteriorly beneath the glutci; or above Poupert's ligament—when pus has formed on the pelvic aspect of the acetabulum and has travelled towards the surface.

Suppuration must always be regarded as an event of some gravity in the course of hip-disease. No doubt there are many cases in which, although no suppuration has occurred, the patients are left in a crippled condition; while, on the other hand, although matter has formed, a very satisfactory result can often be

obtained. The development of an abscess, however, is enough in itself to show that the disease has entered upon an advanced stage; and it is a condition which, unless appropriate treatment is applied, is likely to involve important consequences. A comparison of a series of suppurating with an equal number of non-suppurating cases at once demonstrates the more serious character of the former group.

The period of the disease at which suppuration takes place has a considerable influence on the degree of danger which the event implies. The most threatening cases are those in which the disease is acute from the first, and in which suppuration, accompanied by a persistent rise of temperature, occurs in the first few weeks. Such instances are more likely to be met with in patients—often young children—whose general health has been depressed by a recent attack of measles or one of the other exanthemata, or by some other cause. The tuberculous process not only rapidly invades the structures of the joint itself, but spreads to neighbouring parts. In such cases, when suppuration is developed, it extends over a wide area, a large quantity of pus is quickly formed, and destructive erosion of the tissues is produced.

In other instances acute suppuration of the joint is brought about by the sudden entrance into its cavity of pus which has formed under the epiphyseal plate or around a tuberculous centre in the head or neck of the femur, or in the floor of the acetabulum. In both these groups, unless pus is at once evacuated aseptically, disastrous consequences will follow.

When, as in the ordinary run of suppurating cases, an abscess gradually forms several months after the commencement of disease, if it is evacuated early, by the method described below, sound healing is obtained, and no serious results will be produced.

There is a third form of abscess which deserves particular attention, for it differs essentially from those which have been already mentioned. Its tendencies are, in fact, reparatory, and it is in many instances an event which materially hastens the process of cure. When the tuberculous process has come to an end, its products, if not over-abundant, are gradually absorbed. In other cases, however, when they are in too large an amount to be thus disposed of, they undergo necrosis in mass, and constitute what is virtually a sequestrum. Acting, as would be the case with a piece of dead bone, as an irritant to the tissues, it leads to suppuration and the formation of an abscess, by which it becomes surrounded. The result is that when the abscess is cleared out the "sequestrum" of necrosed tuberculous products is itself completely removed.

Cases are not rare in which, although all active symptoms have subsided, the joint remains month after month in an unsatisfactory state—irritable and sensitive. At length an abscess is detected and opened. After this the case progresses without further drawback, and in a few months sound repair is found to have taken place. The explanation is that a "sequestrum" of necrosed inflammatory products which had previously acted as an irritating agent has been got rid of. This form of abscess is a chief variety of the class which Sir James Paget has termed "residual," and of which he says:—"Most of them are formed where pus, produced long previously, has been wholly or in part retained, and has become dry or in some sort 'obsolete.' But some of them, it is probable, are formed in the thickenings, adhesions, or other lowly-organised products of inflammations long past."

I have seen many of these "residual abscesses" in which, even when they have been of very large size, repair has been fully completed well within a month.

One of the most striking was met with in a boy 10 years old, who had recovered from hip-disease of long standing, for eighteen months, when one day he walked with some companions much older than himself from Pimlico to Greenwich and back. Two days afterwards he was seized with great pain in the neighbourhood of his old disease, and ten days later a very large abscess had formed, and was found, when I was asked to see him, presenting both in Scarpa's triangle and also at the back of the joint. His temperature was 102° . I opened the swelling both in the front and behind, and evacuated sixteen ounces of pus. His temperature at once fell to normal, and within a month all traces of the abscess had disappeared, and both openings were soundly closed. He had no relapse.

There are thus three forms of abscess to be kept in mind—(1) those which occur in the full tide of the inflammatory process; (2) those which are developed when the inflammatory process is subacute, or is dying out; (3) those which are produced when the tuberculous process is at an end, and necrotic products of bygone disease have to be cast out.

3. *Lardaceous disease*.—Formerly, when cases were often left without efficient treatment, when sepsis occurred, and when profuse suppuration was a common result, many patients became affected with lardaceous disease of the internal organs, disclosed by enlargement of the liver, or of the spleen, or of both these organs, or by the presence of albumin in the urine. These patients usually developed anasarca and died of exhaustion, often accelerated, when the intestinal mucous membrane became lardaceous, by obstinate diarrhœa.

This complication must be suspected when discharge is copious and continues for several months, and when the patient is losing colour and flesh. Its occurrence, however, is uncertain; in many cases that I watched in

former years to a fatal termination by suppuration and exhaustion, no lardaceous degeneration occurred. While in other instances, though suppuration had been in progress for only three or four months, and was not very profuse, lardaceous disease was developed, and led to the patient's death. The urine should therefore be often tested for albumin, and the liver and spleen examined for enlargement, in every instance where suppuration is persistent and at all free. In the advanced stage of lardaceous disease the patient becomes feeble and wasted; the skin assumes a waxy pallor; there is general anasarca, first apparent in the eyelids and scrotum; often there is diarrhœa, which it may be difficult or impossible to arrest; and sometimes obstinate sickness. The specific gravity of the urine is at first not below normal, but as the affection advances, and the excretion of urea is more and more interfered with, the specific gravity falls to 1012 or even to a lower point.

Some thirty years ago this condition—as the result of prolonged suppuration, following septic infection occurring when abscesses were opened—was frequently met with. In the present reign of asepsis it is never seen, except in neglected cases or where modern methods have been departed from.

The subject of intercurrent *tuberculous meningitis* is dealt with on p. 61.

The **treatment** of the early stages of hip-disease must provide for absolute rest, and for the removal of any abnormal position of the limb. These conditions may be secured either by a Thomas's splint (Figs. 73, 74) or by weight-extension.

Thomas's splint.—In the case of young children, and when the position of the limb is but little changed, Thomas's splint is both convenient and efficient. If carefully fitted, and kept in place by a carefully applied

bandage for the limb and a wide chest-band, it secures rest and affords a ready means by which the patient can be lifted without disturbance of the joint. When the disease is acute, or the patient restless, a double Thomas's splint may be advisable, for a time at

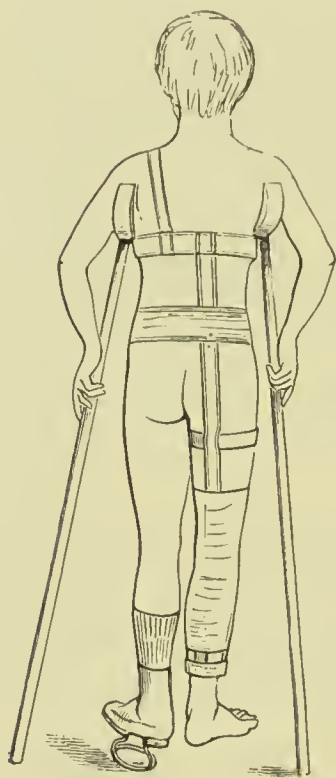


Fig. 73.—Thomas's splint for hip-disease (back view).



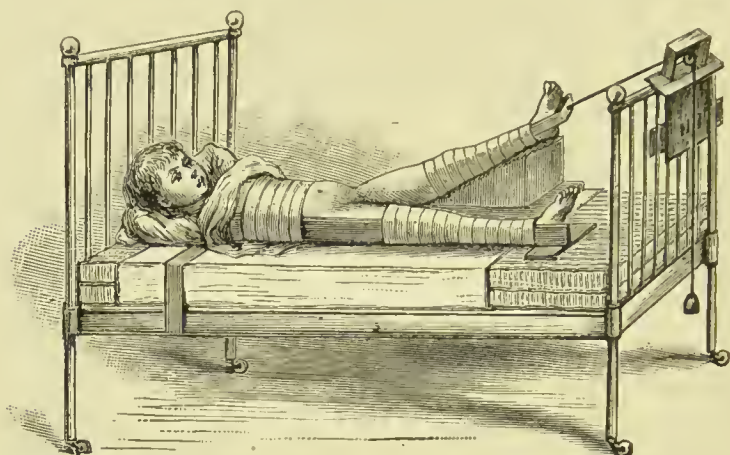
Fig. 74.—Thomas's splint for hip-disease (front view).

least. If the limb is flexed, Thomas's splint may be used to bring it down, in the following way: The splint is bent to fully the same degree as the limb, so that, when it is applied, the limb rests in it without constraint; then it and the limb are well supported with pillows. Under the influence of rest, museular spasm gradually passes off; and, as the limb yields, the splint is straightened to a corresponding degree. The rate at which

the splint may be straightened is ascertained by removing it about every ten days, and noting the extent to which the limb can be brought down without producing lordosis. No attempt must be made to straighten the limb actively by bringing it down to the splint, which is bent up to a less extent than the limb itself. To do so would be to employ leverage, and so produce pressure of the head of the femur against the floor of the acetabulum (p. 519). An advantage that may fairly be claimed for Thomas's splint is that (when once the position of the limb has been rectified) it is more easily managed by parents and relatives than weight-extension is. It remains to add, that during treatment with a Thomas's splint the patient must be placed on a soft mattress, which, by yielding to the splint, will prevent injurious pressure. The splint should be made of iron which is as soft and at the same time as tough as possible. The iron must be thick enough to prevent the patient's bending it, and yet it must permit bending with the aid of wrenches. The wings must be made so that they are readily bent by hand. In length, the splint reaches from the lower angle of the scapula to the junction of the middle and lower third of the leg (in growing children, rather lower).

Weight-extension.—In patients over ten, and also in children under this age, if deformity is marked, I prefer weight-extension; for the weight, as an active force constantly at work, exercises a much more definite influence in removing muscular spasm; and it has always seemed to me much more effective and satisfactory for the removal of any considerable degree of deformity. During the use of weight-extension, the patient must be placed on a firm mattress, with a board beneath it to maintain its level surface. The head-pillow should be somewhat wedge-shaped, and only large enough to support the head in a comfortable position. If it is of the

usual size, the patient will mount his shoulders upon it, so that his trunk is no longer horizontal. In the case of children the mattress should be protected by a piece of waterproof and a draw-sheet. It is absolutely necessary that, for a time, the patient should be confined to the horizontal position. To ensure this a good plan is to apply an ordinary long splint, such as is used in the treatment of fracture of the femur, and reaching as high as the axilla, to the *opposite* or *sound* limb. A chest-



[Fig. 75.—Method of using extension when the limb is merely flexed on the trunk.

band should also be used (*see* Fig. 75). This consists of a piece of webbing, passing across the front of the chest immediately below the clavicles, and ending in two loops, through which the two arms are passed, and through which also is threaded another piece of stout webbing, running transversely across the surface of the bed under the child's shoulders, and fastened at its two ends to the sides of the bedstead. When this is in action the patient's shoulders are kept flat on the bed, so that he can neither sit up nor turn on his side. This chest-band does not cause the slightest discomfort. It is not, of course, fixed tightly, and when the child finds that he

cannot sit up, he makes no further attempt to do so ; and as he lies flat, the band is loose.

The weight is applied by means of a "stirrup," made of stout strapping, of which Leslie's is the best kind I have seen. The stirrup is thus prepared : A piece of strapping is cut, from two to three inches wide, and long enough to extend as an elongated loop from two or three inches below the foot to the middle of the thigh. This is doubled upon itself at its middle, and a piece of wood-shaped like a visiting-card, is placed in the concavity of the loop, and fixed by a transverse fold of strapping, and a drawing-pin at each corner. The loop below the foot is thus "set out," so that the sides of the stirrup stand off from, and do not rub, the malleoli. Through the centre of this piece of wood a strong cord is run over a pulley. The stirrup is fixed by pieces of strapping surrounding the limb, and a bandage. The stirrup should reach well above the knee, so that the ligaments of the knee-joint are not subjected to injurious traction. I have seen several instances in which, when this precaution has been neglected, the knee has become so "loose" that the leg admitted of considerable hyperextension on the thigh. The strapping should only be slightly warmed before it is applied, and the weight ought not to be put on for eight or ten hours, otherwise the stirrup, drawn upon before it has become firmly adherent to the skin, will slide down, and soon require renewal. A well-applied stirrup will last at least three months.

The next step is to substitute the real for the compensatory position (p. 518). If there is lordosis, this means that the limb is flexed on the trunk. To remove it, therefore, the limb must be raised till the lumbar spine is in contact with the mattress (Fig. 75). If the anterior iliac spine on the affected side is lower than the opposite spine, so that there is apparent lengthening, this means that the limb is abducted. The limb must,

therefore, be moved outwards till the spines are again level (Fig. 76). If the iliac spine of the affected side is higher than the other, this means that the limb is adducted, and it must therefore be moved inwards across its fellow till the horizontal level of the pelvis has been restored (Fig. 77). Secondly, into whatever position the limb has now been brought, it must be landed



Fig 76.—Method of using extension when the limb is flexed and abducted.

up on pillows or some other support, on which it may lie at rest. In cases in which deformity is slight, the limb will be only a little raised, and either slightly abducted or adducted; but when deformity is great, the limb must be landed up to a proportionate extent. Thirdly, the pulley must be adjusted in a line with the long axis of the femur, so that extension is made exactly in this line. When this is the case the effect of the weight is, by tending to draw the head of the femur out of the acetabulum, to relieve interosseous pressure; while if the line of traction does not correspond with the long axis of the thigh, the femur is converted into

a lever of the second order, and the acetabulum becomes its fulcrum, with the effect of increasing, instead of relieving, interosseous pressure. (*See* p. 519.) When the limb has been placed at rest under the influence of the weight, other points to be observed are the use of a cradle, to protect the foot from the weight of the bed-clothes; and in cold weather, light wraps to keep the

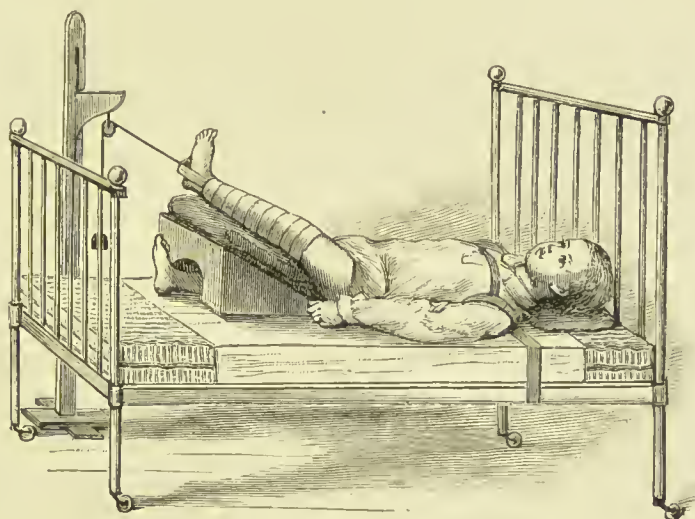


Fig. 77.—Method of using extension when the limb is flexed and adducted.

foot warm. The amount of weight to be applied varies with the age of the patient. In children under ten it should be from three to five pounds; more is very seldom either required or advisable. It is not to its amount, but to its continuous action, that the weight owes its efficiency in these cases. In young adults, six or eight pounds may be required. A caution must be offered against the use of very heavy weights. They are certainly not in the least necessary, and they tend to do harm by the strain they put on the ligamentous structures of the knee, and on other parts of the limb.

It is often surprising to see how quickly this method of weight-extension in the line of the thigh will remove

deformity. In recent cases it will reduce the limb to its natural position in ten days or a fortnight, while even in cases of long standing it will do so in the course of a few weeks. As the limb comes down, the pulley must be readjusted. This is done in the following way : Every three or four days, or at longer intervals, according to the case, while the surgeon holds and slightly draws upon the limb, to imitate the action of the weight, the nurse takes the weight off and removes the supporting pillows. The surgeon then brings down the limb, in the direction of extension, as far as it will come without the production of lordosis, and next moves it in when there is abduction, or out when there is adduction, towards the natural position, as far as it will go without tilting the pelvis. When the improvement has thus been ascertained, the supporting pillows are readjusted to maintain the limb in the improved posture, and the situation of the pulley is changed so that extension is still made in the long axis of the femur. Similar alterations in the direction of the limb and in the line of traction are made from time to time as they can be effected, until at last the limb has regained its natural position of full extension, and lies flat on the mattress, and parallel with its fellow.

In many cases, however, the form of weight-extension just described, although it removes flexion, has no marked effect on either abduction or adduction, so that when the limb has come down into the horizontal position, abduction, showing itself in apparent lengthening, or adduction, showing itself as apparent shortening, will still remain.

Abduction may be disregarded, for if the joint retains any movement it will gradually disappear as repair goes on ; while should ankylosis occur, the presence of abduction will be an advantage rather than otherwise, because the apparent lengthening to which it gives rise

will, in its degree, compensate for the real shortening which the disease is so likely to produce. I have met with several cases in which the limb, from having become fixed in a posture of abduction, had the appearance of being the same length as its fellow, though measurement proved it to be in reality an inch and a half shorter.

Adduction is a much more serious element of deformity than abduction, for although the shortening which it produces is only apparent, yet, in its effect on the patient's power of walking, apparent shortening is practically the same as real shortening; that is to say, if there are two inches of apparent shortening the foot will be two inches off the ground, just as it would be if the shortening were real. A persevering attempt should therefore always be made to correct any adduction that is present—the more so because, if allowed to remain, it usually shows a strong tendency to increase. The following plan may be adopted for its removal: While the weight is still applied to the affected side, counter-extension is applied to the sound side by means of a cord running from the lower end of the long splint (on this side), upwards to the head of the bed, where it turns over a pulley and supports a weight of five or six pounds or more, according to the patient's age. Thus, while one weight is acting so as to draw the pelvis downwards on the affected side, the other weight is acting so as to draw the pelvis on the sound side upwards. This method is often successful. In cases of old disease, in which there has been extensive absorption of the femur and of the acetabulum, so that the bones have become moulded to each other in a deformed position of the limb, little, of course, can be done; but in all cases in which adduction, though very marked, is not accompanied by any considerable change in the shape of the bones, it may generally be entirely removed by this plan in the course of a few weeks.

It seems to me to be of the nature of forcible (though gradual) rectification i.e. tending to produce inter-osseous pressure which is contrary to our principles, &c.

When the limb has been brought down into a position of extension, it may be found to be everted. Eversion may be merely an element in the position of greatest ease (p. 420), not dependent on any structural change. It may, however, be due to absorption of the head and part of the neck of the femur. Although it leads to no serious inconvenience, yet, like all other defects of position, it should be as far as possible corrected. This may be done in the following manner: An outside splint, long enough to reach from the sole to a little above the knee, is furnished with a foot-piece and with a cross-piece at its lower end, about ten inches long. This splint is applied to the foot and leg, and is at first tilted so that it adapts itself to the outward rotation of the limb, and is supported in this position by two sand-bags, one of which is placed under the inner end of the cross-piece and the other upon the outer end. It is then gradually rotated by altering the inclination of the cross-piece by means of the sand-bags, until at last it corresponds to a slightly inverted, instead of an everted, position of the limb, a change of posture that is imparted to the leg and foot, which are fixed to it.

Weight-extension generally quickly relieves any pain that is present. Often a child who has long been in acute pain, and in whom night-screams have been urgent, will sleep soundly throughout the whole night as soon as the weight is in action. Before relief is obtained, the exact weight that is suitable may have to be experimentally ascertained. Sometimes, though but rarely, for a child of five years, instead of the usual four or five pounds, six or seven pounds may, at first, be necessary.

If pain continues, careful search for an abscess should be made; and should pus be found, its evacuation, which should not be delayed, will probably give immediate relief. If no suppuration is detected, the

benzoline cautery should be lightly applied, while the patient is under the influence of gas, to the front of the joint. This will sometimes procure immediate and absolute relief. Should pain still persist, the child should be anæsthetised, if this seems necessary, and a Thomas's splint should be applied in addition to weight-extension. In very few cases will pain continue when these several measures have been adopted, and where nursing is skilful.

When the disease is of long standing, deformity can be removed only slowly, and six weeks or two months will often be required. In some cases weight-extension, however long continued, will fail to rectify the position of the limb. In former years it was the custom to correct deformity by forcible movement when the patient was under chloroform. This proceeding often led to serious mischief. I have known it, in different cases, attended with fracture of the femur; rupture of the ilio-psoas, in one instance followed by abscess, pyæmia, and death; displacement of the upper end of the femur on the dorsum ilii; extensive suppuration around the joint; renewal of disease in an acute form. In almost all instances forcible straightening produces severe and long-continued suffering. Such a violent operation calls for unqualified condemnation, and, indeed, there are very few surgeons who now practise it. But, in the obstinate cases just alluded to, the following modification of this method, while it is free from objection, is very efficacious: When the child is under an anæsthetic, so that the muscles are relaxed, the limb is brought down through two or three degrees (so that the process of extension is started, but nothing more) by manipulation; only very slight force must be used. The weight is now to be reapplied. After this it will often be found that the limb will gradually come down. I have frequently found this method succeed,

and when too much force is not used no harm results, and no pain is produced. In this way the various forms of screw apparatus formerly in use for straightening the hip-joint may be dispensed with. This is a great advantage. They were very expensive, and, moreover, they all acted by leverage, and therefore induced inter-osseous pressure, with its attendant evil results (p. 513 *et seq.*).

Bryant's splint resembles the apparatus, figured in Hamilton's work on Fractures, for the treatment of fractured femur in young children, and consists of two long wooden splints, one for each limb, which are fastened together by a cross-bar at their lower ends, and by an iron rod arched over the chest and connecting their upper ends. So far as I have observed, the objects aimed at by this appliance are generally more satisfactorily attained by the use of a double Thomas's splint.

The American surgeons have introduced splints intended to secure extension while the child is still allowed to move about actively. These are models of inventive ingenuity, and the object which they are designed to fulfil (that is, of conducting treatment without confining the patient to the horizontal position) is highly desirable. These splints, however, in the opinion of the great majority of English surgeons, act, as does a Thomas's splint, mainly by securing rest; while the latter appliance is less costly, and is more readily managed in cases in which technical knowledge cannot always be at hand.

As to the period during which treatment must be continued, no precise rule can be laid down. Each case must be separately considered. It must, however, be remembered that, when once fairly established, the disease is very seldom cured in less than nine months to a year; while as, in the majority of instances,

the affection has been in progress for several months before the case comes under notice, the treatment must often be continued over a longer period. Probably the average time occupied in the repair of this disease is not less than eighteen months, while many examples that ultimately ended very satisfactorily have been treated for as long as three years. The best course is to keep the patient at rest for at least three months after all pain has ceased, and to prolong this period in cases in which the disease has threatened to be severe, or in which the child's health is very delicate, or his family history unfavourable. When the necessary period of rest is thought to have elapsed, if the weight has been used, its amount may be very gradually reduced, at first during the day only, and then also at night. When it is found that this change is followed by neither pain nor contraction of the limb, the child may be fitted with a Thomas's splint, and allowed to be up for a short time daily on crutches, and wearing a high boot on the sound side, so that the foot of the affected side does not reach the ground. The amount of exercise and liberty must be very slowly increased, and great care must be taken that the child does not fall. The weight had better still be worn for several months at night, and the chest-band (Fig. 75) should be continued, to ensure that the patient sleeps on his back. The case must be carefully watched, and if there is pain, night-screaming, swelling about the joint, increased stiffness, or flinching of the patient on movement, no matter in how slight a degree any of these symptoms may be observed, a further period of rest must be insisted on.

Treatment of suppuration.—In no part of the surgery of the joints has more sound progress been made than in the treatment of suppuration. Formerly abscesses were allowed to increase and burrow, and,

after producing wide injury of surrounding structures, and undermining the skin, to burst spontaneously. The result was that sinuses, lined with tuberculous granulation-tissue, and admitting of only very imperfect drainage, were formed. If, on the other hand, abscesses were emptied either by aspiration or by incision, they generally became septic, and free and prolonged suppuration, leading to disastrous consequences, followed. At the present day, when septic infection can easily be prevented, the advantage of removing collections of tuberculous pus, as soon as they are detected, is fully recognised. Indeed, the practice of opening abscesses aseptically, and while they are still of small size, has radically changed the course of tuberculous joint-disease; for prolonged suppuration, wide destruction of bone and the deformity which it produced, the development of lardaceous disease, and the loss of general health—in fact, all the graver dangers involved in these affections—were, for the most part, the direct consequences of septic decomposition in abscess-cavities. As soon as the aseptic removal of pus could be effected, such disastrous consequences were averted; and now diseases, instead of being often fatal, or leaving the patient seriously crippled, are reduced to the level of affections which, though still tedious, and apt to induce minor forms of lameness, yet in the great majority of cases end in perfect or very favourable recovery.

Not only must the pus be evacuated, but the granulation-tissue with which the abscess-cavity is lined must be completely removed. When this has been effected, it often happens that abscesses, even of large size, are obliterated by the primary union of their walls.

The part having been carefully prepared by washing with soap and water, and with a solution of biniodide

of mercury (1 part in 500 parts of methylated spirit), and then covered for twelve hours with earbolie lotion (1 in 60), a free incision is made, and pus allowed to flow out. When the abscess is at all deeply placed, a director or a pair of closed dressing-forceps should be introduced into the cavity immediately the opening has been made, so that the passage be not lost. The cavity is then cleared by detaching the granulation-tissue with which it is lined by means of a Barker's flushing gouge. This instrument consists of a hollow metallie stem ending in a blunt-edged beak, and is connected, by tubing, with a large reservoir of either iodine water (1 part of the tincture in 400 of sterilised water), boric-acid lotion, or earbolie lotion (1 in 40). The gouge must be used with care, otherwise blood-vessels or other important structures may be injured. Sterilised swabs, securely mounted on long holders, may also be used for detaching the lining membrane. When this has all been removed, and the lotion returns clear and free from shreds, the cavity should be sponged out so as to be left dry. Some surgeons then introduce an emulsion of iodoform and glyeerine; others are content to bring the walls of the abscess together by carefully applied pressure, so as to check exudation. The latter has seemed to me the better course. The incision is closed by a continuous suture. Many abscesses treated in this manner will be found to be healed when the dressings are removed at the end of a week. Others close more slowly; but if asepsis is maintained there will be no rise of temperature, and no further suppuration will take place.

In acute disease, if suppuration occurs, the evacuation of pus, with the consequent relief of tension, is followed by the best results. The temperature falls, pain is relieved, and progress towards recovery is generally satisfactory.

There is no doubt that, under continuous rest, abscesses holding as much as six or eight ounces may be absorbed. Such an occurrence, however, is far too rare to be taken into account in the management of any particular case. An abscess had better be opened as soon as it is found. Sir James Paget has recorded instances in which abscess-cavities that had been emptied by absorption of their contents have, either from some disturbance of the general health, over-exertion, or other cause, suddenly refilled; and I have seen several similar instances. Healing is sounder and more permanent when pus has been evacuated and the lining membrane of the abscess removed.

Prognosis in hip-disease.—Thirty years ago the mortality of hip-disease in childhood was probably not much less than 30 per cent. of the cases,* while no small proportion of those who survived became cripples. Such a high rate of mortality was due either to the exhaustion attending prolonged suppuration (often at length producing lardaceous degeneration of the viscera), or to the intercurrent of phthisis, or general tuberculosis (in which case the immediate cause of death was often acute meningitis). Since that period the affection has been closely studied by many authorities in England, on the Continent, and in America, and the principles which govern its successful treatment have been ascertained. It has been proved that everything depends on the early recognition of the disease, fresh air, and the use of long-continued and absolute rest of the joint. The introduction, into England from America, of the strapping stirrup for extension, and the invention of Thomas's splint, have furnished adequate methods for securing mechanical rest. It has been found that the mere maintenance of the horizontal

* Tables in the Report on Hip Disease, *Clin. Soc. Trans.*, xiv. 226.

position, even for one or two years, in good air, has no prejudicial effect on the general health, and that it is only when confinement is combined with pain and suppuration that the health suffers. The old fancy that children kept on their backs would have bed-sores is exploded; and it is now known that no child who is properly nursed ever has bed-sores except when he is suffering from extreme exhaustion. The severe suffering which was formerly regarded as inseparable from the disease is so readily prevented by the agency of weight-extension, or other well-known means, that in the great majority of cases the patient, from first to last, is never in serious pain, while generally he feels nothing of his disease. Pus, as soon as it is detected, can be evacuated without either pain or constitutional disturbance, so that the mischief which in former years resulted from the accumulation and burrowing of pus—the pain, the prolonged fever, the profuse and persistent discharge, the formation of sinuses, and the development of lardaceous degeneration, or some fatal kind of tuberculous disease—can be averted. In these circumstances the mortality of hip-disease, adequately treated, has fallen from about 30 to something under 5 per cent.

As to the *condition of the limb.* (a) In cases that are detected early, and adequately treated, perfect recovery, with complete restoration of movement, may often be obtained. In many others the only appreciable defect is a slight limp, due either to loss of free movement, to atrophy of the muscles, or to arrested growth of the limb. Even in instances in which disease has produced faulty position and suppuration, the treatment by rest, continued for a year or for a still longer period—combined with extension to correct distortion, and with the early evacuation of pus—will often lead to recovery without deformity, with almost

perfect movement in the joint, and with very slight lameness. The old view was erroneous, that, if suppuration once occurred, the only method of repair was by bony ankylosis. I have seen many cases in which, though suppuration has persisted for many months, considerable movement has been retained.

(b) In some instances, though recovery takes place, growth proves to have been to some degree arrested, so that, as the patient increases in height, the affected limb becomes shorter and shorter in comparison with its fellow. I have met with several cases in which this defect in length amounted, when the patient's growth was completed, to as much as six inches, so that, even with a high boot, lameness was very considerable. Such a result, however, is rare.

(c) Parents among the poor often find it impossible to secure proper treatment for their children, and the average period during which disease has been in progress in patients admitted into children's hospitals is about twelve months. In the course of this time the affection has often advanced to extensive bone-absorption and consequent deformity, to suppuration and the burrowing of pus, and to the serious injury of the general health. Even then, however, rest and extension, and the aseptic evacuation of pus, will, in the majority of instances, lead to recovery; although this may not be effected in less than from two to three years. Ultimately deformity will be removed, though, of course, the limb will be short, suppuration will cease, and the general health will be restored. In many cases considerable movement will remain; while in others either firm fibrous or, much more rarely, bony ankylosis will occur. The latter is the more favourable result, for when it has taken place there can be no return of deformity, whereas, when ankylosis is only fibrous, not only may deformity recur, but the cicatricial tissue,

subjected to constant strain, is apt to become involved in renewed inflammation. In some cases the patients walk with scarcely a limp, even when the union is bony. In others, however, owing to the presence of muscular atrophy and arrested growth, lameness is great.

(d) The question of dislocation is important. Cases are occasionally met with, but they are extremely rare, in which the head of the femur, before it has undergone any diminution of size, and while it is still covered with cartilage, becomes dislocated from a normal acetabulum, upwards and backwards on the *dorsum ilii*. I have notes of a case in which dislocation occurred when hip-disease was only of about two months' duration. The dislocation had the characters of an ordinary dorsal displacement from injury. Reduction was effected under chloroform by manipulation. Displacement returned, but, after reduction had been again effected, and weight-extension applied, the dislocation did not recur. This was probably an instance of acute synovitis attended with large serous effusion into the joint, and relaxation of the capsule. Generally, true dislocation does not take place; but, as the result of absorption of the head of the femur, and enlargement upwards and backwards of the acetabulum, the upper end of the bone becomes gradually drawn up by muscular action, so that the trochanter is placed considerably above Nélaton's line. In rare cases, after destruction of the head, the stump-like end of the femur may slip out of the acetabulum—rendered shallow by absorption—and pass upwards upon the *dorsum ilii*, with the result that the limb suddenly becomes shortened to the extent of an inch and a half or two inches. I have seen this take place even when Thomas's splint was being worn. Such an accident would be prevented by combining weight-extension with the splint. Should it occur, the limb should be carefully extended, under chloroform,

and a weight applied. In some instances, after absorption of the head of the femur, the upper end of the bone is found, on recovery, to slide freely upon the dorsum ili through a range of an inch and a half. This condition gives rise to great lameness.

Excision of the hip-joint is discussed at p. 314 *et seq.*

Amputation for hip-disease.—The statistics of amputation at the hip for tuberculous disease of the joint, like those of all capital operations, show that by the methods at present in use the percentage of recoveries has been largely increased within the last few years. The circumstances in which amputation is performed, however, differ so widely in different cases that it is impossible to make an exact statement of the mortality which it involves. The results obtained depend very largely on the bias of the operator in favour of, or against, the proceeding. In the view of many surgeons this amputation involves so grave a mutilation that they shrink from employing it, except as a last resource, and when the chances of recovery from it are no longer very hopeful. Others regard it as a means by which, if it is not too long withheld, many cases that are otherwise hopeless can be saved. They therefore adopt it at an earlier period, with, of course, a much better prospect of success. There is a danger in both these positions, if they are carried to any extreme. There are cases, otherwise hopeless, in which a timely resort to amputation will secure for the patient a life of health and comfort. To withhold the operation in such instances is to leave the sufferer to his fate. On the other hand, to be over-ready to amputate is to run the chance of removing a limb which, if better judgment had been exercised, might have become sound and useful.

From what I have observed I am inclined to think the danger is greater in the direction of amputating

prematurely. I have seen at least three cases in which, after the most careful estimate had been formed, parents were advised to sanction the operation, but refused their consent, and in which the children ultimately recovered with a serviceable limb. And I have elsewhere recorded the instance of a boy who seemed to be slowly dying of hip-disease and profuse suppuration, and in whose case the only ground on which amputation was withheld was that he had not strength to bear it; yet he shortly afterwards began to improve, and at length completely recovered. I have also seen cases in which children whose condition was believed to be hopeless, and who were therefore transferred to a home for incurables, have gradually improved, and have been brought, two or three years later, to good general health, and with their wounds all soundly healed. Nor is it, I hope, presumptuous to say that the high point to which operative surgery has been developed may in itself, unless much deliberation is employed, be a misleading influence. The fact that the operation is now less dangerous than formerly is no reason for resorting to it unless its absolute necessity has, on careful consideration and after consultation with others, been established.

There are several methods by which the operation may be carried out. The two essential points, however, are to restrict hæmorrhage within the narrowest possible limits, and to complete the operation as quickly as shall be consistent with its careful performance. There is an excellent chapter on the subject in Treves and Hutchinson's well-known Manual of Operative Surgery, in which the relative advantages of different operations are fully and ably discussed. Of these methods, two only need be considered here, for they appear clearly superior to the rest, viz. : (1) amputation by the anterior racket-incision; (2) the method of Esmarch.

1. *By anterior racket-incision.*—The following description includes the main points of the operation, but those who are not already perfectly familiar with the proceeding will do well, before undertaking it on a patient, to perform it on the dead subject, and to study the details as Treves has stated them. The vessels are secured as soon as they are exposed, so that no tourniquet is employed; but in children the circulation can be much controlled by digital compression of the aorta. The first incision, which extends only through the skin and subcutaneous tissue, begins at the middle of Poupart's ligament, and passes down in the long axis of the limb for three or four inches. It next runs in a curved direction inwards, and is then carried across the back of the limb to the outer side, and completed by being prolonged in a curved direction upwards until it meets the point at which it commenced. The common femoral artery and vein are now each defined, tied in two places, and divided between the ligatures. As the muscles on the outer aspect of the limb are divided and allowed to retract, the external circumflex artery is exposed. It is tied in two places and divided. Farther back the gluteus maximus is cut at its insertion. The limb is now rotated outwards, and the ilio-psoas is divided, and the internal circumflex comes into view. This is double-ligatured and cut. The adductors are next severed, and then the muscles attached to the great trochanter. The limb is abducted, the capsule opened, and disarticulation is completed. Finally the muscles at the posterior aspect of the limb are divided by a sweep of the knife. As the operation proceeds, any vessels that bleed are immediately secured with pressure-forceps, of which an abundant supply should be at hand.

2. *Esmarch's method* of amputation is identical with that described by Veit, Laeuchie, Volkmann, and

others (Treves). All the soft parts down to the bone are divided by a single sweep of the knife around the limb, about five inches below the tip of the trochanter; the femur is next sawn across, and the vessels are ligatured. The bone is now seized in a lion forceps, and steadied, while a second incision is made, commencing two inches above the tip of the trochanter, and carried downwards so as to terminate in the first circular cut. The two borders of this incision being held apart by an assistant, the bone is cleared of the soft parts by the use of an elevator inserted under the periosteum, and by the knife when the muscles are too firm to be otherwise detached. When the capsule is reached it is divided, and the head is disarticulated.

The chief danger in amputation at the hip-joint is hæmorrhage from the branches of the internal iliac artery distributed to the back of the limb. To obviate this several means have been proposed: (1) Instrumental compression of the abdominal aorta. To this serious objections are that it interferes in a perilous degree with respiration, which may be already feeble, and may bruise the intestine. I have known gangrene follow its use. (2) In a thin subject, and in children, the aorta may be controlled by digital compression by a steady assistant. (3) Mr. Jordan Lloyd has recommended the use of "an elastic tourniquet encircling the innominate bone and checking the whole blood-supply to the lower limb." Full details of this method are given in the *Lancet*.* The drawback to this would appear to be that during the temporary paralysis of the vessels, resulting from compression of their vaso-motor nerves, very free oozing might occur which in the aggregate would amount to a serious loss of blood. (4) There is Davy's "lever." This consists of a cylinder about the size of the ring-finger, and about

* Vol. i., 1883, p. 897.

eighteen inches in length, with an indiarubber sheath drawn over it to protect the tissues with which it comes into contact. It is introduced with great gentleness into the rectum, and carried up the bowel till its entering end reaches the brim of the pelvis, and lies over the common iliac artery in the interval between the lumbar vertebræ and the psoas muscle. The external end of the lever is then gently elevated—the sphincter ani acting as its fulcrum—with the result that the artery is compressed. Some practice is required in the use of this instrument, and great care is essential. Cases have occurred in which serious injury has been done. I have, however, employed it on several occasions, and have seen other surgeons use it, with the result that hæmorrhage has been easily and completely controlled. Before it is introduced, the bowel should be cleared by an enema and injected with a small quantity of oil.*

(5) In recent years some surgeons have practised direct compression of the common iliac artery through a small incision in the abdominal wall.

In either of the two operations which I have briefly described, as the patient is generally a young subject in whom marked wasting has occurred, the abdominal aorta may be controlled by digital compression; or, as I should myself elect, Davy's lever may be used. When, however, the soft parts around the joint have long been involved in inflammation, and have consequently become vascular and brawny, a multitude of small vessels, unable to contract, pour out a quantity of blood. Such vessels can be tied only with difficulty, and with the expenditure of much valuable time. This form of hæmorrhage is best arrested by douching the surface with boric-acid lotion at 110° F., and by firm bandaging of the stump for six or eight hours after the operation. I have performed the

* *Brit. Med. Journ.*, 1879, ii. 685.

operation on thirteen occasions: the first six, which occurred many years ago, were done by the old transfexion method. In the other seven, Esmarch's method was employed; and in the majority of these Davy's lever was used. In three, excision had already been performed. Of the total number, five sank within a few hours, and two, though surviving the operation, ultimately died of lardaceous disease and exhaustion depending on extensive disease of the pelvis. Of the remaining six, four perfectly recovered, while in two, though the wound was still incompletely healed (in one four, and in the other six months after the operation), the general health had greatly improved, and albumin, previously copious, had disappeared from the urine.

These results, which extend over a period of upwards of twenty-five years, are, no doubt, less favourable than would be obtained in dealing with cases of a similar kind at the present time. The operation has been facilitated in many ways, and its safety has been enormously increased, by the method of wound-treatment now in use. The mortality attending the operation at the present day, in cases in which it has been advisedly performed, I should be inclined to estimate at about 25 or 30 per cent. I may add that much depends upon the degree in which the operator has familiarised himself with the particular method which he adopts.

The operation may be performed—

1. When hip-disease is complicated with extensive disease of the shaft of the femur, attended with copious and persistent suppuration, and especially if lardaceous degeneration is making its appearance.

2. When excision has been done, but has failed to arrest suppuration, and the general health has given way. Here amputation is much simplified, and is, therefore, rendered much less dangerous by the previous excision.

3. When the patient, as the result of extensive disease of the joint, is steadily losing ground, and when it is believed that his general health would not enable him to carry out repair after excision.

4. In some instances of free suppuration associated with disease of the pelvis, amputation may be advantageous, either by securing free drainage, or by enabling the operator to remove diseased bone that cannot otherwise be reached. The presence, however, of disease of the pelvis which is either extensive or of long standing must generally be regarded as a strong reason against the operation. Indeed, this condition is the main local factor which interferes with recovery. It has certainly been the chief cause of the failures that have come under my own observation.

*The cases may resemble
chronic appendicular sinus.*

CHAPTER XXXI

CONGENITAL DISLOCATION OF THE HIP

THE general subject of congenital dislocation of the joints falls under the head of orthopædic surgery, and will not be considered in the present work. I shall, however, offer an account of congenital dislocation of the hip, for this condition occupies an exceptional position. It is far from uncommon, and is met with in individuals who are otherwise healthy; while congenital dislocation of other joints is very rare, and is found chiefly in combination with other grave malformations, or with arrested development of the central nervous system. Moreover, on account of its reputed rarity and the obscurity of its features in many instances, it is apt to be overlooked or mistaken for some affection of an entirely different kind, whereas congenital dislocation of any of the other joints is self-evident and offers no difficulties in diagnosis.

It is to the great French surgeon, Baron Dupuytren, that we are indebted for the first detailed description of this condition; and he it was who termed it original or congenital, to distinguish it from those displacements which are due to accident, and those which result from disease. As is so often seen when a novelty is being dealt with, Dupuytren's description was drawn from the most obvious examples, and contained no reference to instances which, although they are less marked, yet constitute a much more numerous group. Hence, too narrow a conception of this affection has been accepted, with the result that many instances are overlooked, or

mistaken for some other affection. I shall have, therefore, to describe varieties to which Dupuytren in his paper does not allude.

Symptoms.—The main points which Dupuytren* observed are the following: The condition is much more common in females than in males. Usually both hips are affected. The gait is peculiar and, to the experienced eye, characteristic: it consists of a rocking or rolling movement of the trunk from side to side, which has been compared to the waddle of a duck, or the motion of the hind legs of a cow during a trot. In the most severe cases the limbs are adducted, inverted, and somewhat flexed at the hip and the knee, so that the heels are drawn up and the individual walks on the heads of the metatarsal bones, and with the feet turned in. The trunk oscillates from side to side at each step, being inclined to that side upon which the weight is, for the moment, thrown. With each step, also, the pelvis sinks upon the corresponding thigh-bone, and all the signs of dorsal dislocation on that side become well marked. The shoulders are thrown back and the abdomen protruded, and there is marked lordosis. The patient is short in stature, and, when the arms hang down, the finger-tips reach nearly to the knee instead of corresponding, as they naturally do, with about the middle of the thigh. “The labour,” Dupuytren remarks, “with which these individuals walk would naturally lead one to expect that the acts of running and leaping would be still more difficult to them; yet this is not so, for in executing these efforts the energy of the muscular contraction and the rapidity with which the weight of the body is transferred from one limb to the other render the effects, arising from the unstable condition of the heads of the thigh-bones, almost inapparent. It is true there is an

* Dupuytren, “Diseases of the Bones” (Sydenham Society, 1847).

unusual rocking of the body from side to side, but even this is less seen in the act of leaping."

On examining the hips in an extreme case, all these peculiarities are easily explained. The natural ball-and-socket connection of the lower extremity with the trunk is found to be entirely wanting (Fig. 78); so that the upper end of the femur can be moved freely about on the side of the pelvis, through a range, in different cases, of from half an inch to as much as four inches. In children, and in adults who are not very stout, it can generally be ascertained that the head of the femur is somewhat small.

When, in the erect position, the weight of the trunk is thrown upon one limb the pelvis sinks, so that the

great trochanter is high above Nélaton's line, and the trunk is apparently shortened. Viewed from behind, the hips appear very broad, in consequence of the projection of the trochanters much above their normal level, and the displacement and bulky fullness of the gluteal muscles. As the head of the femur is



Fig. 78.—Congenital dislocation of the hip-joint. The acetabulum is absent, and the femur moves loosely upon the pelvis. The head of the bone, however, is enclosed in a very strong capsule.

(From a specimen in St. Thomas's Hosp. Mus.)

situated not only above, but considerably behind, the natural position of the acetabulum, the centre of gravity of the trunk is displaced forwards, and the pelvis undergoes rotation on its transverse axis, with the result that not only is lordosis produced, but, in order to preserve his balance, the patient is obliged to throw his shoulders far back, and consequently to protrude his abdomen. The waddle is due in part to the existence of double dorsal dislocation, and the altered direction of the thighs; but to a large extent also to the fact that when the body is thrown alternately from one limb to the other it oscillates widely before it meets with firm support, owing to the want of any bony connection between the trunk and the lower extremity. The lower limbs are seen to be somewhat small and wanting in muscular development, and have the appearance of being unnaturally short.

Fig. 79, taken from a specimen in the museum of St. Bartholomew's Hospital, illustrates in a striking manner all the principal features of the condition in extreme cases. The history of the patient is not known. The pelvis is that of an adult female. The head of each femur is dislocated upwards and backwards on the dorsum of the ilium. The capsular ligaments, which have been partially removed, form strong sling-like bands, by means of which the pelvis was suspended between the two thigh-bones. There is no trace of the ligamentum teres. The heads of the femora are small and irregular in outline. In the position of the acetabulum on each side is a shallow, irregular depression, much smaller than the natural joint-cavity, and filled to the level of the surrounding bone with fibrous tissue. Above and behind this is an irregular patch on the dorsum ilii, where the bone has evidently been worn down and roughened by the friction of the head of the femur, which, instead of being fixed in a socket, was

free to slide on the side of the pelvis. The thigh-bones, which are slender, are adducted and rotated inwards, so that they cross each other above the knees and the lineæ asperæ look directly outwards. The lumbar vertebræ, three or four of which are preserved, show, from their relation to the sacrum, that lordosis was extreme.

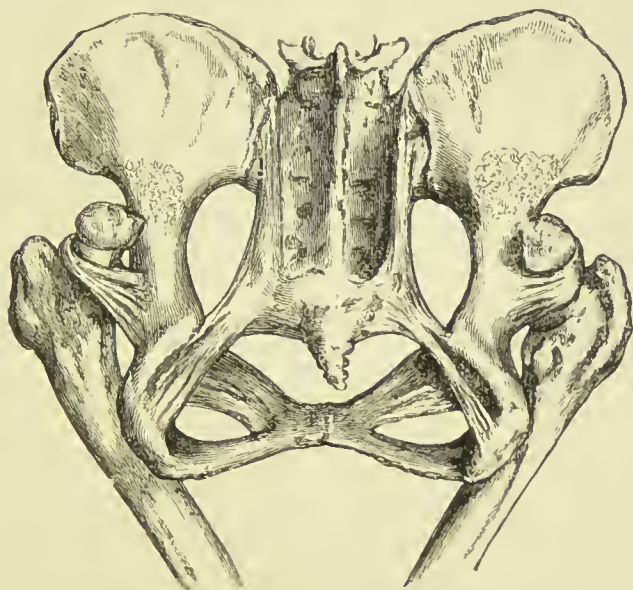


Fig. 79.—Congenital dislocation of the hip-joints.

(From a specimen, No. 1,050, in St. Bartholomew's Hosp. Mus.)

The gait of this individual must have been exactly like that which Dupuytren observed in his cases.

The instances, however, of the deformity which reach this extreme degree are comparatively rare. In the majority of cases, though the femora are displaced, they are either retained in their abnormal position by a more or less perfect false joint; or they are connected with the pelvis by a strong and short capsular ligament, so that they slide on the dorsum ilii to only a limited extent. When the latter is the case, or when there is no sliding at all, the roll from side to side and the difficulty and

labour of progression are very largely diminished, and the adduction and inversion of the lower extremities to a great extent or entirely disappears.

The position which the head of the femur occupies in relation to the side of the pelvis has an important influence alike on the amount of deformity and on the patient's power of locomotion. When the femur is situated far back on the dorsum *ili*, lordosis is well marked, for the line of gravity of the trunk is displaced. It lies in front of the heads of the thigh-bones, and, consequently, the pelvis undergoes rotation on its transverse axis, and the curve of the lumbar spine forwards is increased. In many examples, however, the false joint is situated immediately above, or it may be even slightly in front of, the normal position of the acetabulum; when this is the case, lordosis, and the throwing back of the shoulders and protrusion of the abdomen, are either absent or very slight, and instead of being flexed, adducted, and inverted, the lower extremities admit of extension so as to occupy a line vertical with the trunk, and are free from adduction and inversion, the heels come easily to the ground, and locomotion is but little affected.

In these milder cases the only symptoms are that the patient has a peculiar gait, with more or less of a roll from side to side; that walking and running are performed with more than natural effort (but this defect may be very slight), and that movement is a little insecure, so that the patient is apt, especially during early childhood, to trip, or tumble about. On examining the hips, the trochanters are found above Nélaton's line, and either directly above or above and a little behind the natural position of the acetabulum, or close to the anterior superior spine of the ilium. Sometimes, by inverting the limb, the head of the femur, which may be apparently either normal, or small and mis-

shapen, can be readily felt rotating in a shallow false joint. Sometimes, also, a little sliding may be detected on one or both sides, especially when the thigh is semi-flexed on the trunk. The general direction of the limbs, however, is perfectly natural, and their muscular development shows but very slight defect. There is no inversion of the feet. Movement is free in every direction, except that abduction and rotation outwards are a little restricted. As the position of the head of the femur on the two sides is sometimes not symmetrical, one limb may be a little shorter than the other.

Even when the thigh-bones are free to slide widely on the side of the pelvis, the actual symptoms may be so comparatively slight that the nature of the case may be misunderstood. The following is not only a remarkable example of congenital dislocation, but is a good illustration of the above remark. The notes were taken in 1874 :—

Mrs. B— is now 36. She says that she could not walk till she was 2½. She was then found, and she has since continued to be, lame, and was noticed to walk with a peculiar roll. At the age of 7 she was taken to Sir Benjamin Brodie, whose opinion was that she had congenital dislocation of both hips, and that she should be treated first by confinement for six months in the horizontal posture in combination with some means for keeping the limbs extended, and afterwards by the use of instrumental supports. This scheme was never carried out, and she was left for whatever improvement in her walk might come with time and exercise. As she grew up she was gradually able to walk much better, and her lameness troubled her less and less. When old enough, she was employed to serve behind a counter, and she followed this occupation till a few years ago, when she married. She is now robust and strong. She says she has always been active, and has frequently walked distances of ten miles, feeling then, as well as after standing many hours at her counter, only moderate fatigue. At the present time, her carriage, though peculiar, would, as she has grown stout, scarcely attract the eye, unless particular attention was drawn to it; but then it would be noticed that the shoulders are thrown back, the abdomen is prominent, the loins hollow (lordosis), and the lower limbs too

short to be in due proportion to the trunk and arms, so that the hands reach nearer than is natural to the knees. Her gait presents little of the rolling movement from side to side that is usually seen. There is no adduction, the heels come firmly to the ground as she stands or walks, and the feet are not turned in. As the connection of the lower extremity with the trunk is essentially the same on the two sides of the body, one description will suffice for both. The upper end of the femur is so movable that, as she stands on one leg, the patient can, by a muscular effort, shift the opposite femur on the dorsum of the ilium, first drawing it vertically upwards for nearly four inches, and then letting it suddenly drop down again. When she does this, surfaces of bare bone are felt rubbing upon each other. As she stands, the pelvis sinks down between the two uprights formed by the thigh-bones till it is suspended, and then the trochanters may be felt about three inches behind the anterior iliac spines, and nearly on a level with the highest part of the iliac crests. Lordosis is very marked. The glutei, pushed up by the femur, stand out in a mass, which gives the posterior aspect of the hips an appearance of remarkable width. When the patient is recumbent, the femur so readily slides on the pelvis that the length of the limb may be varied through a range of nearly four inches. The limbs lie in a position of complete extension, and there is no inversion of the feet. The pelvis is of ample size, and the patient's confinements have followed a natural course. The hereditary transmission of this defect is alluded to at p. 475.

Many instances occur in which only one hip is affected (Plate 7). Indeed, from what I have seen, I should say that single is more common than double dislocation—a circumstance to which I wish especially to direct attention, for cases of unilateral deformity are those that are most often misunderstood, and are mistaken either for infantile paralysis or old-standing hip-disease. In these patients the affected side presents precisely the same anatomical variations as those observed when both hips are involved. There may be an entire absence of anything like a joint, and the head of the femur may either slide freely about, or be firmly retained in a false joint, close above the natural site of the acetabulum; while between these extremes of defect all intermediate



PLATE 7.—CONGENITAL DISLOCATION OF THE LEFT HIP.

There is a well-formed acetabulum.

(Radiogram by Dr. Hugh Walsham.)

degrees are met with. The patient's carriage and powers of progression will, of course, vary with the local conditions of the hip. When there is no joint, and the thigh-bone is free to slide about, the child drops towards the affected side with a limp as marked as that accompanying a minor degree of infantile paralysis; while in cases of slight anatomical defect the use of the limb is very little impaired and lameness is proportionately diminished.

It is well to remember that not only may the clinical features of these cases be but faintly marked, owing to the fact that the anatomical defect is, in many instances, comparatively slight, but further, that as the result of anatomical variations on the two sides the symptoms may be so far modified as to throw the true nature of the patient's condition into obscurity until it has been fully investigated. This was well shown in a case under the care of Mr. Morgan, in the Hospital for Sick Children, which I have his leave to quote.

A girl, aged 9, seen in 1882, had congenital dislocation of both hips. In walking or running there was very little roll of the trunk from side to side; but she moved with difficulty, as if she were suffering from muscular rigidity of the limbs such as is often seen in affections of the spinal cord; and she was much more lame on the left than on the right leg. The two limbs were unsymmetrical, the left knee being maintained in a posture of slight flexion, while the right could be easily extended. She walked on the toe of the left foot, and very insecurely; while the right heel came fairly to the ground. There was very little lordosis. When she was lying on her back the right limb would be fully extended and abducted to a considerable extent on the trunk; but the left could not be extended, and abduction was very limited.

Few, I think, would have anticipated the true explanation of these symptoms, and it was only when the hips were carefully examined, and the position of the trochanters ascertained, that it was found that on the left side the head of the femur was so loosely

connected with the dorsum ilii just in front of the sacro-sciatic foramen that it could slide to the extent of about three-quarters of an inch. On the right side the head was enclosed in a false joint above and a little behind the normal side of the acetabulum.

Etiology.—Until recently the origin of congenital dislocation of the hip was involved in considerable uncertainty. The opinion that some examples are traumatic in their origin derives some support from cases that have been recorded, such as the following: Some years ago I saw a little girl, aged about 4, with congenital dislocation of the right hip; and a surgeon, practising at Islington, but now deceased, told me that he attended the mother at the birth of the child, that there was a breech presentation, and that while he was endeavouring to effect delivery by using a blunt hook, he distinctly felt the head of the femur slip out of the acetabulum. He added that he had always blamed himself for not having taken means at the time to reduce the displacement. Though such accidents are probably rare, and although some may even doubt their existence, the possibility of their occurrence should be borne in mind when force is being used in the manner related.

I have met with two instances in which a fall in early infancy may perhaps have led to injury the effects of which simulated congenital dislocation. One may be briefly noticed. John W——, when six months old, fell to the ground through a distance of about four feet, striking his face and head, and injuring his right thigh, so that a day or two later a considerable ecchymosis appeared around the hip. The pain that followed was not severe, and only lasted a few days. The injury was forgotten till four months later, when he began to use his limbs in attempts at walking. It was then seen that he could not bring his foot to the ground. On examination when he was nine years old, I found the great

trochanter flattened, and drawn up so as to be very nearly level with the anterior iliac spine, and situated between that process and the acetabulum. It is easy to believe that the fall had produced separation of the head of the femur from the neck, and that this was a case of coxa vara deformity following separation of the epiphysis (*see* Chapter XXXII.). It may here be mentioned, in passing, that, after acute arthritis occurring in an infant a few weeks old (*see* Acute Arthritis of Infants, p. 407), the hip-joint may be left completely disorganised. When this is the case, should the patient survive, the condition of the hip may so closely resemble congenital dislocation that it may readily be mistaken for this affection.

But while some cases may not improbably be the result of injury, and while some instances that usually pass for congenital dislocation really belong to an entirely different group, we must look for some other explanation. This becomes apparent when it is remembered that congenital dislocation is very much more common in females than in males; that it is frequently double; that there is often no history of injury of the fœtus in utero, that birth was perfectly normal, and that no force was used; that the position of the false joint is frequently above, or in front of, rather than behind the normal position of the acetabulum, and that the deformity is occasionally hereditary.*

There remains the view that the condition is the result of defective development. This subject has been investigated by Bowlby and Lockwood. Both have produced specimens to show that the upper part of the acetabulum is absent. Lockwood, in dissecting a micro-

* Many authors allude to this, and Dupuytren quotes from Maissiat the perhaps doubtful history of a family in Mantua, many members of which, in different generations, are reported to have suffered from this defect.

cephalic infant, still-born at full time, found that the cartilaginous rim of the acetabulum was entirely absent, while all the other constituents of the joint were present; and in a male, at full time, born with ectopia vesicæ, and other arrests of development, the rim of the acetabulum was absent, and the head of the femur was lying on the dorsum ilii, near the anterior iliac spine. The ligamentum teres was very long, and the capsule capacious and normally attached. In the opinion of this observer, the defect depends on the failure of the pelvic cartilage to grow—as it normally does—round the head of the femur. Bowlby gives the following account of the dissection of a specimen removed from a girl who died at the age of 18: “In the position of the normal acetabular cavity is a triangular depression, which, although it represents the acetabulum, is far too small to have accommodated the head of the femur at any time. . . . The edges of the depression are scarcely raised above the level of the surrounding bone. The upper portion of the normal acetabulum, which, from being formed by the ilium, may be called the iliac segment . . . appears to have been suppressed, so that the ill-developed acetabulum represented by the above-named triangular depression is formed merely by the coalescence of the pubic and ischiatic segments.” This condition is well shown in Fig. 80, taken from a specimen (No. 42, Section D) in St. Thomas’s Hospital Museum. Mr. Shattock has described this specimen and furnished a woodcut of it.* It is important to notice that in several dissected specimens in the London museums this triangular outline of the acetabulum is very distinct. I think these examples leave no doubt that it is in defective development that the true explanation of the condition is to be found, and the descriptions which I have quoted appear to show

* *Path. Soc. Trans.*, xxxviii., plate xii.

conclusively that the defect may consist either in the suppression of the iliac segment, or in the failure of the pelvic cartilage to grow up and surround the head of the femur, so as to constitute a retaining brim. From what I have seen I am led to believe that the condition most frequently present is that which Bowlby has described. The great thickening of the capsular ligament which is met with in these cases is illustrated in Fig. 81.

Diagnosis.—

Unless a thorough examination be made, it is very easy, especially when the slighter forms are in question, to mistake this condition for some other affection. In one instance, indeed, the patient, a girl of

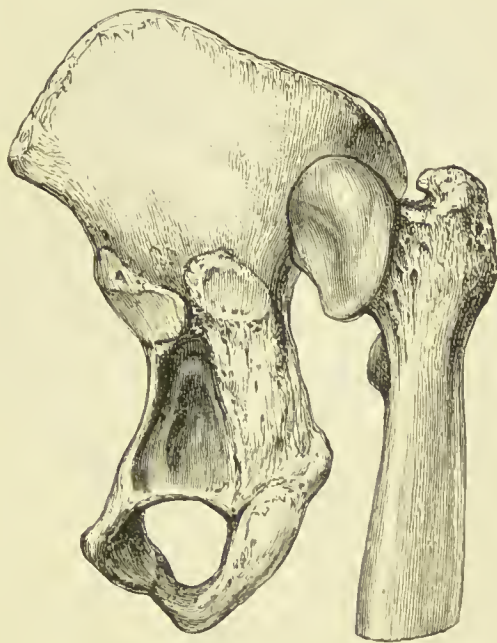


Fig. 80.—Congenital dislocation of the hip-joint. The acetabulum is shallow and triangular.

9, had been treated for seven months for double hip-disease by splints and a long succession of blisters. No one, however, who has met with one of these cases, or who will bear the following points in view, is likely to fall into error: (a) The defect is much more common in females than in males. (b) Though often affecting both sides, it is by no means rarely confined to one, and it is the unilateral cases that are most likely to be overlooked. (c) The history is very similar in all the cases, and is to the effect that the parents knew nothing

of the defect till the child, on learning to walk at the age of fourteen or eighteen months (these children almost invariably are late in getting on their feet), was found to be lame, or to roll from side to side, and to be so unsteady that it often fell. (d) There is usually no reliable

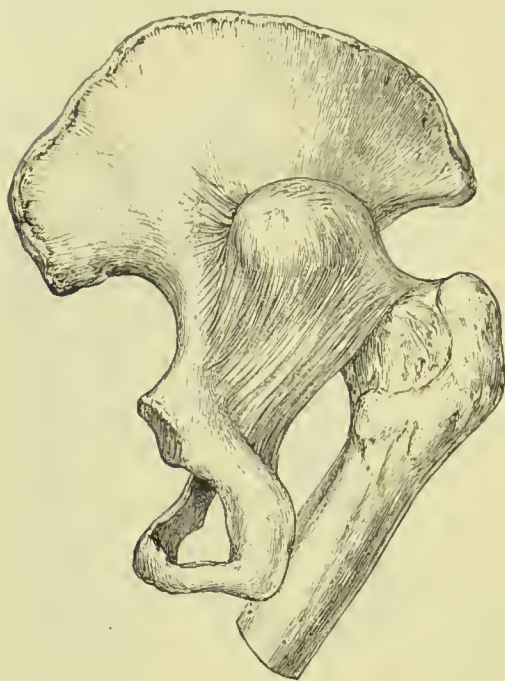


Fig. 81.—Congenital dislocation of the hip-joint, showing great thickening of the capsular ligament. (*Shattock, Path. Trans.*, vol. xxxviii.)

account of any injury, and the child has not complained of pain; and though easily fatigued, has always shown an inclination to run about as much as others of the same age. (e) Though in the worst cases, such as Dupuytren described, the limbs are flexed, adducted, and inverted, and the patient walks on the toes, in the much more common and less

severe examples the position of the limbs is perfectly natural, and the heels easily come to the ground. (f) The limbs are usually somewhat small and thin, and deficient in muscular development. When only one side is involved, the limb, in comparison with its fellow, often looks wasted, as if the seat of a minor degree of infantile paralysis, and in children three or four years old there is frequently an inch or more of shortening. (g) Movement in every direction is usually

perfectly free, except that abduction is somewhat limited. (*h*) Lordosis, though most authors speak of it as always present, varies considerably in its amount and is sometimes entirely absent. Both it and the associated protrusion of the abdomen and throwing back of the shoulders depend on the relation of the heads of the thigh-bones to the sides of the pelvis. When the thigh-bones are free to slide, so that, as the patient stands, an aggravated form of dislocation upwards and backwards occurs, or when the false joint is placed behind the normal site of the acetabulum, the line of gravity is thrown forwards, the pelvis becomes rotated on its transverse axis, and lordosis is proportionately developed. But when the false joint is situated above, or above and in front of the natural position of the acetabulum, the line of gravity is not displaced, and therefore no lordosis and no throwing back of the shoulders are produced. All the ~~se~~particulars should be carefully noted; but the crucial test is (*i*) that, in combination with them, there is displacement of the trochanter.

Sometimes the trochanter is freely movable. It slides about—perhaps with an obscure sensation of grating—when the femur is manipulated, to the extent of an inch and a half or two inches, even in a child; or this sliding may be very limited, and apparent only when the shaft is pushed, in the flexed position of the limb, directly backwards. Sometimes there is no sliding, but the trochanter lies distinctly, often considerably, above Nélaton's line, in a position either above and behind, above, or above and in front of the normal site of the acetabulum. This altered relation of the trochanter to Nélaton's line is invariably present. But two points must be borne in mind: first, that the defect is sometimes so slight, and the trochanter is so little displaced, that the real condition of things may easily be over-

looked; and second, that in rickety curvature of the femur, and in coxa vara deformity from other causes, the neck of the bone not infrequently stands at a right angle or less to the shaft, with the result that the trochanter lies considerably above Nélaton's line. It is, therefore, here, as in so many other instances, necessary to look well to all the points of the case, and to consider negative as well as positive evidence. If the child has been lame ever since he first learned to walk, if there is no sign of any other affection accounting for the symptoms observed, if the gait is peculiar, and if the patient has never complained of pain, then, even if a slight fault in the position of the trochanter is combined with limitation of abduction, and with lordosis, and especially if the opposite hip is normal, the case may be regarded as one of congenital dislocation. While if, although the trochanter lies, on both sides, distinctly above Nélaton's line, the history shows that the deformity, absent at first, has been slowly increasing, if the child is rickety, if other bones are curved, and if the muscular system is weak, it may be concluded that the state of the hip and the waddling and unsteady gait are due to rickets.

The above remarks on the diagnosis of congenital dislocation of the hip were written prior to the introduction of X-rays as an aid to surgical diagnosis. At the present time there is a tendency to neglect clinical methods of diagnosis, and to delay diagnosis until an X-ray picture has been obtained.

The conditions for which congenital dislocation is apt to be mistaken are hip-disease, the disorganised and "loose" joint left after acute arthritis in infants (p. 407), infantile paralysis, separation of the epiphysis of the head of the femur, and rickets in the form above alluded to. The symptoms of hip-disease, which are widely different from those of congenital dislocation

are fully discussed in Chapter XXX., the condition of the joint after acute arthritis of infants in Chapter III., and infantile coxa vara in Chapter XXXII.

Treatment.—No doubt, in cases in which the femur slides on the side of the pelvis, weight-extension, while the patient is in the horizontal position, will bring the head down into the best available position; but the question is, by what agency it is to be retained in this situation when walking is resumed. Is it supposed that the head becomes attached to the pelvis by some kind of ankylosis, or that the capsule, previously elongated, now shrinks around the head and becomes thickened so that the head can no longer slide? Neither assumption has any evidence to support it. On the other hand, the following case is instructive. I was asked to see a young lady who, I found, had congenital dislocation of her right hip, with sliding of the femur through a range of an inch and a half, and with two inches of shortening. I then heard that the patient had, some time previously, been treated, for a period of two years, by horizontal extension. A cure was supposed to have resulted, and the case was published as such. Full relapse had, however, subsequently occurred.

Of late years determined efforts have been made to deal with this condition by active surgical interference. Several methods have been advocated. These, in general terms, have (a) consisted in attempts to replace the head of the femur by an open operation, or to construct a new acetabulum by gouging out a cavity, in which the head could be lodged. Of these methods it must be said that they involve—as the subjects are young children—material danger to life, while the results obtained in regard to the local condition itself have been disappointing. The strong probability is that in future these procedures will be discarded, or used only in exceptional cases.

(b) The method originally practised by Lorenz consisted in stretching or tearing the muscles around the joint so that all resistance was overcome, and then endeavouring to replace the head. It is easy to see that a proceeding which involved such extensive and haphazard injury of growing muscle, though it might be a stepping-stone, could not last. As a matter of fact, it was soon given up.

(c) The procedure at present in favour, which we owe chiefly to Lorenz, and which has without doubt been attended with an encouraging measure of success, consists in manipulating the limb with the object of replacing the head of the femur either in the rudimentary acetabulum or as near this as possible, and retaining it there by putting up the limb for several months in plaster-of-Paris, in a position of wide abduction, and then, by allowing the child to walk with the limb fixed and abducted, to aim at the formation of a more normal acetabulum by means of the constant pressure of the head in its new position.

For this method to be successful it is essential that the child should be quite young, and yet be old enough to have learnt to walk. After about seven years of age the shortening which occurs in the muscles and ligaments generally prevents anything like perfect reposition.

The following are the stages of this method :—

1. *The reduction of the head.*—An anæsthetic is given and then a towel is placed round the perineum and held by an assistant. Extension is carried out gradually by pulling steadily on the thigh until the great trochanter can be brought down nearly to Nélaton's line. At the same time this is aided by kneading the tense muscles, especially the adductors close to their attachment to the pelvis. Combined with this extension, as the muscles yield the thigh is abducted and the adductors stretched. *No violence must be used.*

2. *Reposition of the head.*—Having rendered it possible for the head to descend to the rudimentary acetabulum, it is now necessary to attempt to clear this space, which is probably occupied by the front of the capsule, in order that the head may be replaced. The perineal band is removed, and the thigh fully flexed, and at the same time pushed down and rotated outwards, so as to direct the head forwards. The next step is gradually to abduct the thigh, while in the flexed and everted position. By this movement the capsule is stripped from the acetabulum. Considerable patience is required and repeated manipulation is usually necessary before the head is felt to slip into the acetabulum. If any violence is used, especially in abduction, the thigh may be fractured. In some cases the head will not slip in unless the thigh is internally rotated in the fully flexed position before abduction is carried out.

3. *Fixation of the limb.*—When the dislocation has been reduced the limb must be fixed in plaster-of-Paris, in the abducted position. The amount of abduction necessary in any individual case is ascertained by gradually adducting from the fully abducted position, until the head just stays in the acetabulum, and then slightly increasing the abduction.

The limb is then fixed in plaster-of-Paris, with the head of the femur in the acetabulum and the thigh rotated outwards and somewhat over-extended. The knee is flexed and the plaster carried below the knee.

The limb is allowed to remain in this position in plaster for about three months. It is well to take the precaution of having the limb skiagraphed after reposition, to make sure that the position is correct.

At the end of three months the plaster should be removed, and it will then be found that the abduction can be diminished without return of the dislocation.

The limb is again put in plaster with the minimum of abduction and the knee no longer flexed, so that the patient can be gradually trained to walk on the abducted limb. By this means pressure is maintained on the head of the femur and on the cavity of the acetabulum.

At the end of about six months of plaster retention it should be possible to discard the fixed support without the recurrence of dislocation. Massage and movements are then carried out to strengthen the muscles.

∴ In considering treatment, it has been too much the custom to speak of these cases as if they were all alike. As a matter of fact, the anatomical conditions are subject to great variations. In many instances the defect is slight, for the head of the bone lies in the immediate vicinity of the acetabulum and is enclosed in a capsule of normal dimensions, so that there is no sliding. Moreover, the head is not displaced backwards, but lies directly above the acetabulum, or even in a forward position near the anterior iliac spine. In such cases the symptoms are slight and the functions of the limb are but little impaired. Shortening is less than an inch; there is little roll or lurch, and no lordosis; while the slight lameness which is present is due quite as much to the defective muscular development of the limb as to the condition of the joint itself. In this group the defect is so limited and the improvement which can be secured is so small that prolonged treatment of a tiresome character cannot be reasonably advised, especially as it must involve a good deal of muscular wasting with a corresponding increase of lameness. It is better to add some cork thickening to the boot on the affected side to compensate accurately for shortening, and to train the child to walk as well as possible. In cases which involve a serious defect, especially where there

is sliding of the femur, an attempt to reduce the dislocation and to retain the bone in position should be made ; but the surgeon's position will be correct and judicious only when he has explained, in any given case, that the degree of success cannot with any certainty be foretold.

CHAPTER XXXII

COXA VARA

THIS term has been applied to a variety of conditions which result in alteration of the angle of the neck with the shaft of the femur. The term expresses a deformity, and is not in itself a clinical entity.

Fiorani, in 1881, first described the deformity as it had been observed by him in infants; and Keetley, in 1888, was the first to call attention in this country to the condition as it occurs in adolescents. During the past ten years it has attracted general attention, and the literature on the subject has become voluminous.

Our knowledge of the deformity has been greatly advanced by the accumulated evidence of radiograms and by the study of specimens which have been resected.

No better work has been done in elucidating the pathology of coxa vara than by R. C. Elmslie in his very admirable Jacksonian Prize Essay (Royal College of Surgeons, 1905), to which those who are interested in this subject would do well to refer. The evidence which he has brought forward conclusively establishes a traumatic origin for most of the adolescent cases, so that in the great majority of cases coxa vara is but a term to express the deformity resulting from separation of the epiphysis of the head from the neck of the femur.

Coxa vara is essentially a static deformity. Normally the weight of the body is evenly distributed through the heads and along the necks of the femora. If, as the result of injury or disease, there is some weakness in the supporting structure, then the bone will yield at that

point. The term coxa vara should be restricted to cases of simple local deformity, which can for the most part be traced to injury, and should be avoided in referring to depression of the neck of the femur occurring incidentally in destructive disease, such as osteomyelitis or osteo-malacia and the like. As a deformity following epiphyseal injury it has a definite clinical and pathological existence, and calls for a definite line of treatment.

Two distinct types may be recognised, the infantile and the adolescent, the former resulting from a displacement of the epiphysis before the bony neck has developed, the latter a separation of the epiphysis from the bony neck.

In the discussion of coxa vara it is proposed here only to deal with these two types, considering similar deformities, when they occur in the course of general diseases, such as rickets or osteo-malacia, or in inflammatory processes, such as osteo-myelitis or tubercle, merely as incidents in those diseases. I begin with

ADOLESCENT COXA VARA

Pathology.—Adequately to appreciate the pathological anatomy of these cases, it is necessary to follow the steps of development of the upper end of the femur.

It is not until about the fifth year that the bridge of cartilage which unites the head and great trochanter becomes separated by the outgrowth from the shaft of the bony neck (Fig. 82), and it is not until about the twentieth year that the head becomes united to the neck. Various factors may be brought into play to interfere with the growth of the upper epiphysis. Accident or disease may alter the normal relations of the epiphysis to the shaft, and the weight of the body, subsequently acting unequally on the two sides, may accentuate the deformity:

The natural angle which the neck forms with the shaft is in the fœtus about 140° , and this is reduced in the process of development, by the weight of the body, to 125° in adolescence. In health the angle continues virtually the same throughout life, and in limbs that

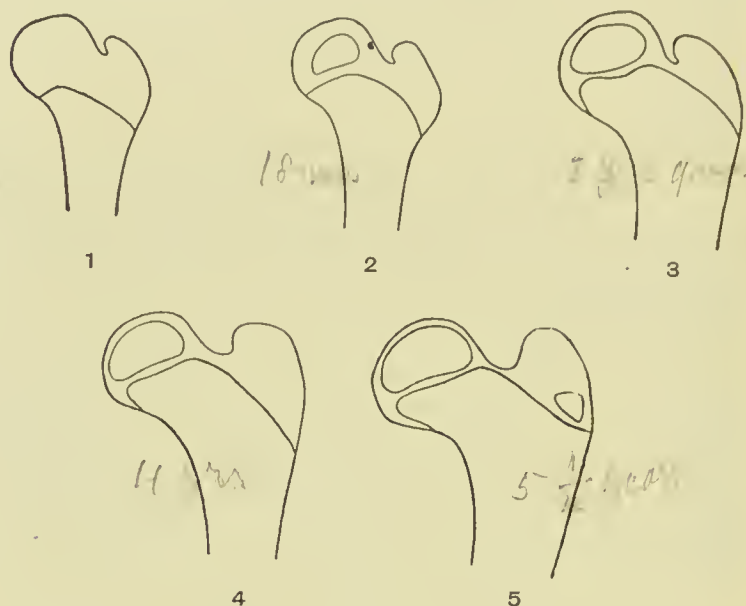


Fig. 82.—Diagrams of the upper epiphyseal region of the femur: 1, at birth; 2, at 18 months; 3, at 2 years 9 months; 4, at 4 years; 5, at 5½ years.

(From radiograms.)

have never borne weight it remains the same as in the fœtus (coxa valga).

It is easy, then, to surmise that a slight disturbance in ossification, whether from injury or disease, may, when the weight of the body is brought into play, considerably modify the ultimate angle of the neck with the shaft, and, by diminishing this angle, produce the deformity known as coxa vara.

It is interesting to note in this respect that the maximum period of growth has been shown to be between

15 and 17 in males, and slightly earlier in females, the period at which adolescent deformities in general are most marked.

One of the most notable features in the history of these cases is the insidious onset, with a history of a slight initial injury often unheeded at the time. It may be that there is some factor in the process of ossification as yet undiscovered which renders the epiphyseal lines of certain individuals more susceptible to injury than others; otherwise, it is not easy to explain a deformity so uncommon resulting so easily from a slight injury. Severe accidents resulting in immediate separation of the epiphysis will, as a rule, meet with prompt treatment, so that the deformity of coxa vara will less readily follow.

Macroscopic evidence in resected specimens.—In Elmslie's analysis of the changes found in twenty resected specimens from adolescent cases the following anatomical changes were noted.

1. The site of the bend was at the line of junction of the head and neck; in no case was the curve at the root of the neck, and in each case the head was displaced downwards and backwards.

2. In the neck, close to the epiphyseal line there were indications of irregularity in the growth of the cartilage and in the process of ossification, the neck being arched, and often showing a prominent spur indicating the upper limit of the former attachment of the epiphysis. In some cases there was a ridge running downwards and forwards from this projecting point, further indicating the former line of attachment.

These anatomical changes, confirmed by the evidence of skiagrams, seem definitely to establish, as the pathology of adolescent coxa vara, a sliding of the epiphysis, followed by a disturbance of growth and secondary adaptive alterations. The deformity which follows this

displacement and subsequent repair results in an arched neck with the head facing downwards and backwards, and a consequent elevation of the great trochanter, combined with adduction and eversion of the thigh (Fig. 83).

Microscopic changes.—In the neck, close to the epi-

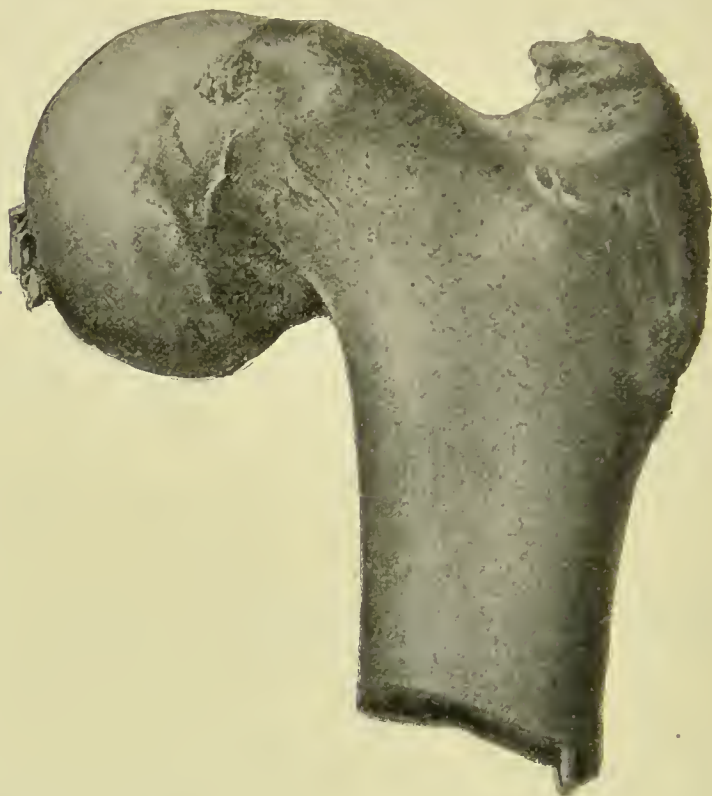


Fig. 83.—Adolescent coxa vara. From a patient in whom the deformity came on gradually after an injury. The original outline of the lower border of the neck is clearly shown. (After Schlesinger.)

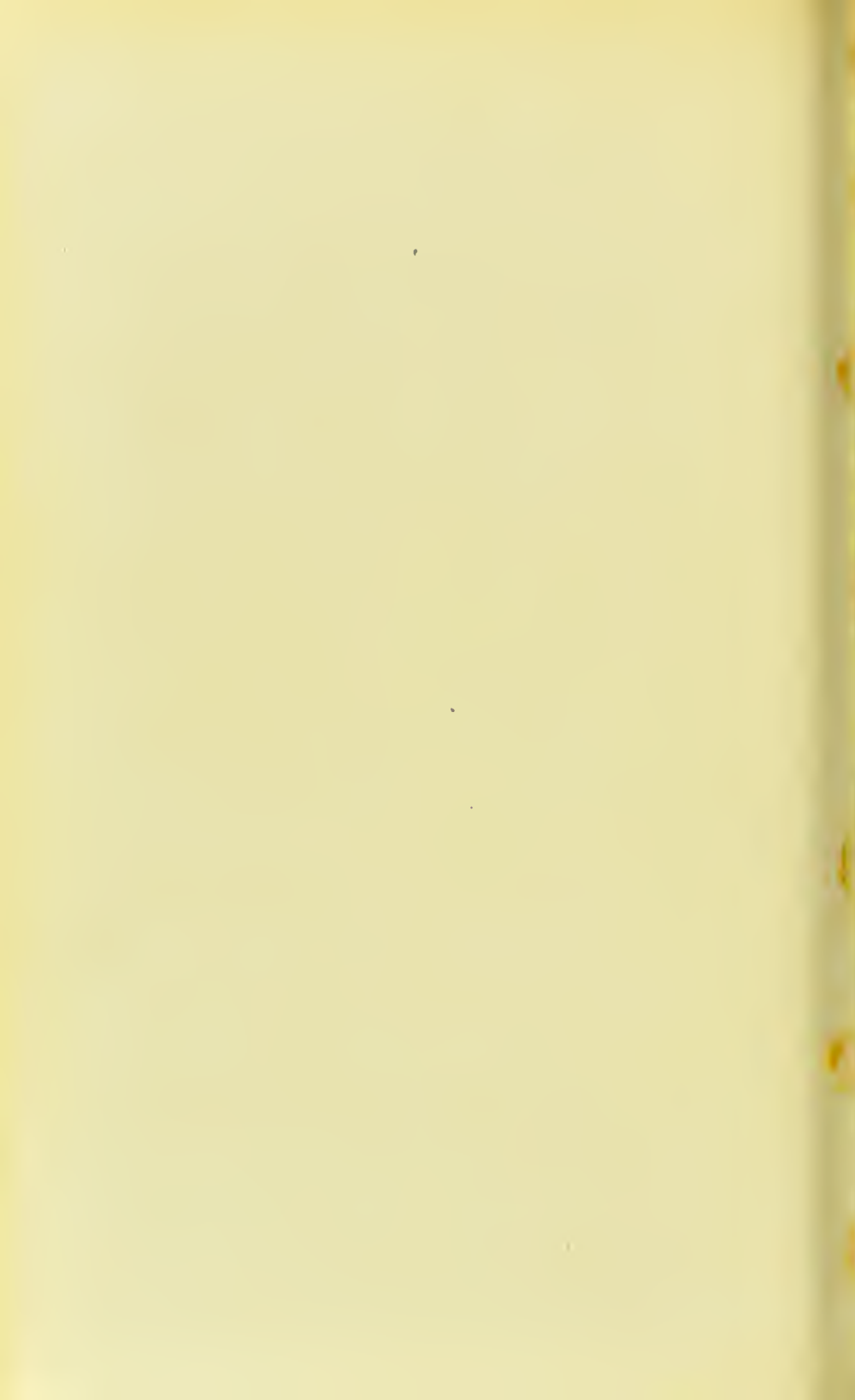
physeal line, there is considerable irregularity in the growth of the cartilage and process of ossification, the cartilage-cells dividing irregularly into uneven columns. Islands of cartilage are found quite separate from the epiphyseal line. Such changes might sometimes be



PLATE 8.—SEPARATION OF THE UPPER EPIPHYSIS OF
THE FEMUR, PRODUCING COXA VARA DEFORMITY,
IN A BOY AGED 16.

The upper border of the great trochanter is on a level with the upper margin of the head, and the lower border of the head is close to the small trochanter. The epiphyseal line of the neck, from which the head has been separated, is well seen.

(Radiogram by Dr. Jordan.)



found in rickets, but would be more extensive, and similar changes have been seen in healing after separation of the epiphysis.

Radiographic evidence.—The head is seen to dip down—i.e. to be tilted on its horizontal axis—and to be no longer entirely in the acetabulum. It is also tilted backwards on its vertical axis by the eversion of the femur and forward projection of the neck.

The epiphyseal line appears unnaturally long, because a portion of the concavity of the cup-shaped end of the neck is shown where it is exposed by the displacement of the head.

There are two distinct parts to the neck: first, that portion next to the shaft, which is natural, except that the upper border is rounded off; secondly, the part next to the head, which slopes downwards and then inwards, giving a hook-like appearance to the lower border. This part is often less dense, showing imperfect ossification. The head overhangs the end of the neck like a mushroom. The upper border of the whole neck forms a continuous convexity upwards, the inner portion of the curve being formed by the original epiphyseal line, which has become more or less rounded off.

A prominence is often shown at the apex of the convexity, marking the spot where the epiphysis was attached (Plate 8).

Clinical history.—The cases observed fall into two main classes: (1) those in which there is a definite history of injury; (2) those in which no history of injury is obtained.

In the former class the injury may be severe, and be followed by immediate deformity, though sometimes without causing great pain or disability. These are cases of acute traumatic coxa vara, directly due to separation of the epiphysis.

In other cases there is only a slight injury, with no

immediate symptoms, but followed, often weeks afterwards, by lameness, shortening, and eversion of the limb.

In the second class the patients first notice stiffness in the hip, great impairment of movement, and pain which is worse after exercise. If these patients are examined in the early stage the limb will be found to be adducted, externally rotated, and slightly flexed. This stage, which is for a time progressive, is followed by a quiescent period in which the stiffness diminishes and pain is only noticed after sitting or lying down. Muscular wasting has now become marked, abduction and internal rotation are limited, but otherwise movement is not impaired.

These cases are liable to be mistaken in the initial stages for early tuberculous disease, but may be distinguished by the well-marked adduction present, which is never found in early hip-disease.

Real shortening seldom exceeds an inch, but the marked adduction produces two or more inches of apparent shortening (Fig. 84).

The combination of deformity present results in prominence of the great trochanter, with lordosis and an apparent short leg on standing. In the bilateral cases (which, however, are rare) there is a great resemblance to congenital dislocation, especially in the cross-legged method of progression.

Elmslie records one bilateral case out of eighteen adolescent cases, and Whitman four out of twenty-seven. Of these twenty-five were males, and all were between the ages of 13 and 17.

Treatment.—We have to consider the prevention of deformity after injuries to the epiphysis, the treatment during the progressive stage of deformity following injury, and the correction of deformity which has become established. The early recognition of injury to the epiphysis is of the greatest importance, and it

must be remembered that the initial injury may be very slight, and the symptoms but little suggestive of the result that may ensue. The importance of radiography has already been considered. It seems probable that often some sudden strain may loosen the epiphysis without displacing it, and that displacement follows when the weight of the body acts on the loosened head. Consequently it is most important that rest should be enforced in the recumbent position, and, if any displacement is visible by means of the X-rays, weight-extension should be applied with the limb abducted, as fully described at p. 441; or a double Thomas's extension-splint may be employed. The patient should not be allowed to be up until firm union is assured, and then a Thomas's knee-splint should be worn for at least six months, so that, if possible, growth may continue on normal lines, unprejudiced by the weight of the body.

If the displacement is excessive, so that the head has slipped down behind the neck, even though no union



Fig. 81.—Unilateral adolescent coxa vara, showing elevation of the pelvis and marked apparent shortening due to adduction.

(From a photograph lent by R. C. Elmslie.)

has occurred, it will be found very difficult or impossible to correct the external rotation, though an attempt should be made under an anæsthetic, and the limb put up with weight-extension, well abducted and inverted. In a recent case, in St. Bartholomew's Hospital, of acute traumatic coxa vara following an accident a few days previously, replacement of the head was secured by means of forcible inversion combined with abduction under an anæsthetic. Skiagrams were taken before and after manipulation, which demonstrated both the initial deformity and the subsequent reposition. The patient was afterwards treated by weight-extension with the thigh abducted, and left the hospital with a limb practically unimpaired. This must be considered as an exceptionally favourable result, when we consider that there are no means at our disposal for fixing the head while manipulating the neck by means of the shaft.

If vicious union has occurred and the deformity is confirmed, the resulting adduction will cause considerable impediment to walking, and can best be corrected by a subtrochanteric osteotomy. The alternative operation of removing a wedge from the neck is a more difficult procedure, which can hardly produce a better result, and may, indeed, result in non-union, owing to the difficulty of firm fixation. Resection of the upper extremity of the femur has in many cases been performed, especially by German surgeons; but the results are not encouraging, and it cannot be recommended in preference to osteotomy.

In old-standing cases it will often be necessary to combine osteotomy with tenotomy of the adductors to obtain the necessary abduction.

INFANTILE COXA VARA

Although the deformity of coxa vara is most commonly met with in adolescents as a result of epiphyseal

sprain or separation, as already described, it may yet occur in early life.

Elmslie records twenty cases of infantile coxa vara, eight in boys and twelve in girls, eight of the twenty being bilateral, thus contrasting with the adolescent type, which is far more common in males and usually unilateral.

Clinical history.—The onset is usually insidious, and the parents are seldom able to state when the symptoms first commenced, though in a certain proportion a waddling gait was noticed when the child commenced to walk. As a rule, the symptoms become marked when the child begins to grow rapidly, between the ages of 6 and 7.

Flexion is always a marked feature, and extension of the thigh very limited, so that the lordosis at once attracts attention and suggests the severe form of congenital dislocation, especially as it is always combined with adduction, and in bilateral cases sometimes with cross-legged progression (Fig. 85). The movements are never restricted in all directions, there is no period of immobility as in the adolescent cases; and though eversion is the rule, inversion is sometimes present. The eversion, when it exists, is seldom so marked as in the adolescent type. Occasionally there is a clear history of injury, such as the following:—

A girl, aged $13\frac{1}{2}$, was an out-patient in the orthopædic department at St. Bartholomew's Hospital. At the age of 3 she fell off a chest of drawers on to her left thigh. The hip was painful, but she was able to get up and walk. Three months later her mother noticed that she was lame and took her to a hospital, where she was treated as an in-patient, and subsequently sent out in a Thomas's splint, and said to be cured. When seen at the age of $13\frac{1}{2}$ the thigh was flexed and considerably adducted, the great trochanter was half an

inch higher on the left side, movements at the hip were free except that abduction was abolished, and extension was limited. A radiogram showed depression of the femoral neck to less than a right angle,



Fig. 85.—Bilateral infantile coxa vara with well-marked lordosis, resembling double congenital dislocation.

(From a photograph lent by R. C. Elmslie.)

the head overhanging the neck below; also a well-marked gap in the neck above (Plate 9).

Pathological anatomy.—It has already been mentioned that up to five years of age there is a continuous bridge of cartilage extending along the upper border of



PLATE 9.—INFANTILE COXA VARA.

The left hip-joint in a case of bilateral infantile coxa vara at the age of 13. Owing to the altered position of the head and direction of the neck, the great trochanter is brought into close contact with the ilium in such a way as to prevent abduction of the thigh.

(Radiogram by Dr. Finzi.)

the neck between the head and great trochanter of the femur, while along the lower border of the neck bone has been formed (*see* Fig. 82).

In radiograms taken of two cases at the age of five, a downward displacement of the head, carrying with it the adjoining portion of the base of the neck, has been seen. If this has occurred in the manner shown in Fig. 86, it will be understood that the lower part

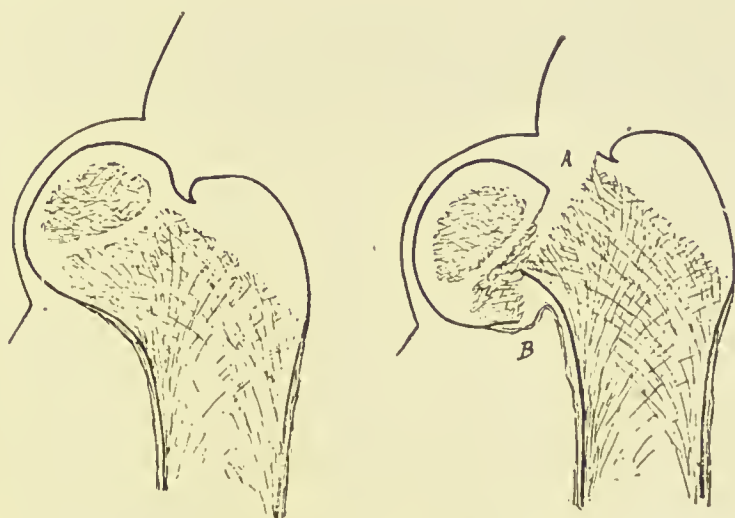


Fig. 86.—Diagram illustrating the probable mode of production of infantile coxa vara. (*Elmslie.*)

A, V-shaped gap produced above; B, periosteal attachment below.

of the separated fragment will probably be retained in apposition with the adjoining portion of the base of the neck by the periosteal covering; whilst in the upper part a V-shaped gap will appear, owing to a solution of continuity of the cartilaginous bridge. It will be realised that, once this displacement has occurred, the weight of the body will increase the deformity, and that, owing to the altered position of the epiphyseal line, the growth of the neck (which takes place mainly after the fifth year) will be in a downward, instead of an upward, line from the great trochanter.

That this is the condition which actually exists in infantile cases is illustrated by Plate 9.

Causation.—Accident may undoubtedly cause the lesion, as in the case cited, and the radiograms in traumatic cases are practically identical with those of the non-traumatic cases. Injury during birth may possibly account for some of the bilateral cases. Many of the patients are known to have suffered from rickets in infancy, and it is not unlikely that the soft condition of the bone due to defective ossification in the first two years of life permits the first displacement of the head. Then, when all active rickets has subsided, the mechanical factor of the body-weight tends steadily to increase the deformity.

Treatment.—Treatment of the infantile variety must be conducted on identical lines with that which is appropriate in the adolescent cases (p. 492 *et seq.*).

In a bilateral case with cross-legged progression, under the care of Mr. Gordon Watson (Plate 9), an excellent result followed a double subtrochanteric osteotomy combined with tenotomy of the contracted adductor tendons. The case is recorded, with radiographic illustrations, in the *Transactions* of the Royal Society of Medicine (Clinical Section), vol. ii., part i., p. 204.

CHAPTER XXXIII

NERVOUS MIMICRY AND HYSTERIA

It is to be regretted that although the word hysteria is gradually being discarded, it is for the present necessary to employ the word, both in general surgery and in its more limited application to diseases of the joints. This archaic expression still survives, partly because it has been so long in use that it cannot easily be expunged, and partly because everybody is well aware that it is no longer employed in a literal sense, but as a familiar and convenient name for a group of disorders which, in the present state of our knowledge, cannot be placed under any definite heading in pathology. A common, and at the same time the main, characteristic of so-called hysterical affections is that they depend on some disturbance of the nervous system unassociated with any alteration or defect of structure that can be detected. They nevertheless lead to symptoms identical with those which arise when some obvious structural or organic lesion is present. Sir James Paget, who in his "Clinical Lectures and Essays" has drawn attention to this question, while condemning the use of the word hysteria as absurdly derived, and, being often employed as a term of reproach, worse than absurd, has introduced the term nerve-mimicry, or neuromimesis, to indicate those cases in which a nervous disorder produces an imitation or mimicry of organic disease. The various forms of neuromimesis of joint-diseases that may be met with will best be illustrated by a few typical cases.

Case 1.—Annie M——, aged 14, was brought to the out-patient room of St. Bartholomew's Hospital with the left knee so strongly flexed that the heel touched the tuber ischii. Her mother said that, fourteen days before, the child had fallen down upon her knee, and that the limb had contracted two days afterwards. A bruise was still visible over the prominent part of the internal condyle of the femur. On examination of the knee I could find neither swelling, heat, nor tenderness; in fact, the joint looked perfectly normal. Regarding the contraction as of mere nervous origin, I pretended to search for and find a particular spot in the popliteal space, and, pressing my finger strongly in, peremptorily ordered the patient to straighten the limb. She did so at once, and while the finger was still pressed upon the surface she walked round the room. The contraction did not return.

Case 2.—A girl, aged 10, was admitted into the Children's Hospital for the treatment of hip-disease, from which she was said to have been suffering for about six months. On investigating I noticed these points: The limb was drawn up by tilting of the pelvis to the extent of more than three inches, and strongly adducted and rotated inwards, so that the great toe rested on the dorsum of the opposite foot. The whole limb was cold and the skin was mottled and dusky. There was no swelling about the hip; the joint appeared to be stiff, but the patient complained so much of pain on the slightest touch, and threw herself into such a contorted posture by arching her spine forwards and still further twisting her pelvis, that the real condition of the joint could not be made out. When she had been for a few days under observation, it was ascertained that she never complained of pain in the limb at night, and only when an attempt was made to alter its position; that the position of the limb varied very much, and was sometimes found to be nearly natural; and that she could move herself in bed without pain. She walked apparently with great difficulty, but without pain, and kept the foot of the affected limb in a position of marked equinovarus. There was distinct, though not marked, muscular wasting. When she was under chloroform every trace of deformity at once disappeared, and the movements of the joint were perfect in every direction. This patient slowly recovered under the influence of careful training and the use of the faradic current. The symptoms of real disease that were so strongly imitated were tenderness of the surface, pain upon movement of the limb, loss of motion in the joint, lameness, slight wasting, and deformity induced by contraction of the adductor and other muscles round the articulation. Diagnosis, however, was easily arrived

at by observing that although the various symptoms just enumerated are all signs of inflammation of the hip-joint, they occurred in a manner that was inconsistent with the view that they depended on real disease. Thus while tenderness was much more acute than it usually is in even severe disease, it was accompanied by no swelling and by no heat, or redness of the surface, as if an abscess was forming. While the patient complained of severe pain on the slightest movement of the joint, she was never disturbed at night, either by pain or by starting of the limb—symptoms which would certainly not have been absent had the pain felt on movement depended on inflammation of the joint. Again, although so much pain was produced by movement of the limb, there seemed to be very little when she attempted to walk. The manner in which she walked, too, was not like anything seen in acute joint-disease. The limb was swung in a loose and almost flail-like fashion, as if partly paralysed, totally unlike the gait of a person who is using the limb for the purpose of fixing and protecting an inflamed joint. And, further, the wasting of the limb, though present in a slight degree, was much less marked than it would have been in the course of active disease. The suspicion of nervous mimicry, excited by the observation of these features of the case, was confirmed when the limb was found to be perfectly movable under chloroform, but to become rigid again as soon as the effect of the anæsthetic had passed off.

Case 3.—Mary B—, aged 26, presented herself at St. Bartholomew's Hospital for advice concerning her right elbow. She said that three months before she had sprained the joint while wringing a wet cloth. The same night the elbow had become excessively painful, stiff, and so tender that she could not bear even the slightest touch upon the surface. The stiffness and sensitiveness still remained. On examination I found the joint quite free from both swelling and heat; indeed, the surface was dusky from feeble venous circulation. But whenever it was touched the patient shrank away as if pain was severe. The smallest attempt at movement made her scream, and although great gentleness was used she threw herself into a state of nervous agitation during the examination. When she was under ether the joint passed, with the exercise of scarcely any force and without any sign of the giving-way of adhesions, into a position of full extension, and was found to move with complete freedom in all its natural directions. It, however, at once became stiff when the patient regained consciousness. Three applications of the faradic current completely cured this case.

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In some instances, instead of muscular spasm, which fixes a joint in one position, a *condition of paralysis* may be met with, so that the patient has lost all power of moving the joint. A young woman, of whose case, however, I have only imperfect notes, had complete paralysis of the extensors of the wrist, so that the hand hung at a right angle with the forearm in the manner observed in the wrist-drop of lead palsy. She complained of considerable aching about the joint, and of a burning sensation over the back of the carpus. The hand could easily be brought into line with the forearm, but it dropped as soon as the support was removed. There was, however, no pain, and no other sign of disease. Electrical reactions were normal. This case, like that just related, was cured by a supporting splint and a few applications of the faradic current. The case was a well-marked example of the condition which Sir James Paget speaks of as one of "want of will, amounting to feebleness or complete negation of will in reference to the supposed seat of disease, while towards other things the will is strong enough. A girl who has will enough in other things to rule the house, has yet not will enough in regard to her limbs to walk a step with them, though they are as muscular as ever in her life. She says, as all such patients do, 'I cannot.' It looks like 'I will not,' but it is 'I cannot will.' " * It will be observed that though the foregoing cases, which are illustrations of a large group, are classified as instances of nervous mimicry affecting joints, they are really examples of nervous disorders of the muscular system, only involving the joints by rendering them either rigid or powerless.

In a third group the joints are affected by nervous mimicry in the form of *intense pain*, which is more or less constant, but which is aggravated whenever an

* "Clinical Lectures and Essays," 2nd ed., p. 188.

attempt is made to use them. Patients are sometimes seen who, after a slight blow or a sprain of the hip or knee, complain of such severe pain that they are unable to bear any weight on the limb, or even to place the foot on the ground. On examination, however, the joint is seen to be free from all appearance of disease. There is no swelling, the temperature is normal, and the muscular wasting is very slight, or entirely absent; and when an anæsthetic has been administered, movement is completely free and smooth. These neuralgic or painful joints are met with most commonly in persons who suffer from cold feet and hands, chilblains, and other signs of feeble circulation, and the joint itself is often cold, and the skin over it dusky from venous congestion.

Diagnosis.—A point of considerable importance in the diagnosis of these cases of hysteria or neuromimesis is that, though the limb may be considerably distorted in respect of its mere posture, no real deformity is present, and the natural position, and with it free movement, is at once regained when the patient is under an anæsthetic. Thus, in Case 1, muscular spasm had drawn the patient's heel into contact with the tuberosity of the ischium. This position, however, was merely the extreme degree of natural flexion. In Case 2, the thigh had become considerably adducted on the pelvis, and then the pelvis had become, for compensation, very much drawn up on the affected side (Fig. 71A). The position, however, was a mere posture of the limb, which entirely disappeared under ether. These contractions never produce the form of displacement of the bones which is met with, e.g. in disease of the knee, as the result of organic disease. In some cases, indeed, it is very suggestive of neuromimesis affecting the knee, that although the joint may be the seat of severe pain, hyperæsthesia, and complete dis-

ability, it remains for many weeks, or even for months, in a posture of full extension. Occasionally two joints may be involved. In one patient both knees, and in another the right knee and ankle, were affected: the knee remained fully extended, brawny, and hyperæsthetic; the ankle was fully extended in a position of equinus, rigid, cold, and over-sensitive.

Bearing in mind that the principal symptoms of organic disease of the joints are pain, swelling, heat, stiffness, and muscular wasting, it may be useful to glance at each of these in its relation to nervous mimicry.

Pain.—The main features of the pain that accompanies neuromimesis are that it is generally out of all proportion to the other signs of disease, and that it is evidently very largely of mental origin. The surface of the joint is so exquisitely sensitive that the patient will not bear the slightest touch, and any attempt to move the joint produces an amount of suffering which, were it due to inflammatory disease, would certainly be associated with heat and night-startings, muscular wasting, and considerable constitutional disturbance. Besides, pain radiates widely, so that it extends, in the case of the knee for example, from the hip to the lower part of the calf. As a matter of fact, however, in these cases the patient looks perfectly well, there is no fever, the general health is quite unaffected, there is no pain to disturb a sound night's rest, and the patient may often be observed to move in bed with a freedom which would be impossible in active joint-disease. Moreover, when the mind is diverted the joint bears both firm pressure and some movement (if these tests are not suddenly produced so as to recall attention to the joint), without complaint; and it is not only free from abnormal heat, but is often unnaturally cold, and the skin is blue and dusky.

Swelling.—In a large number of instances swelling

is entirely absent, so that although the joint is stiff, and the seat of an amount of pain which, were it due to inflammation, would indicate considerable disease, there is obviously no effusion either into the synovial cavity or the soft structures surrounding the articulation. This absence of swelling is a very important diagnostic sign, for whenever inflammation is present in any joint except the shoulder and hip, in which, from their deep situation, it cannot be detected, some swelling is invariably met with. It must, however, on the other hand, be remembered that swelling is occasionally seen about joints in cases of mere nervous disorder or nervous mimicry. Such swelling presents itself, not in the form of exudation into the cavity of the articulation, but as an ill-marked puffy effusion into the surrounding areolar tissue, often attended with transient heat or flushing of the surface, and with hyperæsthesia of the skin. In two cases this swelling was present not only in the soft structures over the knee itself, but it could be traced for some distance up the thigh in the form of thickening about the lower end of the femur, as if the result of chronic periostitis, or even of some inflammation of the bone. For several months it underwent but little change, and at length slowly disappeared. Such swelling is, in fact, very similar to the œdema which is not rarely met with in *tic-douloureux*, or in other forms of severe neuralgia. Although swelling of this character may at first sight appear to depend on organic disease, a careful study of other symptoms of the case will disclose its real nature.

Heat.—Very important evidence may be derived from the presence or absence of heat. As I have already mentioned, a joint that is the seat of nervous mimicry is not only, as a rule, free from heat, but is often colder than natural—obviously colder than the corresponding joint of the opposite limb—and this

defective temperature is accompanied with a weak condition of the circulation, so that the surface feels cold and clammy; and if pressure is made with the tip of the finger, the displaced blood returns so slowly that the whitened patch is only very gradually reddened again. All this is the rule, yet it must be borne in mind that although the case is one of mere nervous mimicry, the joint may present an unnatural amount of heat. This heat may easily be distinguished from that which depends on organic disease, for it is inconstant and very variable, absent during the greater part of the day, so that the joint is then perfectly cool, and returning only towards evening or at some particular hour of the day; and it is often associated with flushing of the skin and with transient hyperæsthesia. Sometimes it is noticed that although the joint is usually cool, or even cold, it becomes hot as soon as an attempt is made to use it, or when the patient's attention is strongly directed to it. In all such cases it is much more important to notice that the joint is generally cool than that it is occasionally over-warm and flushed, for it may be safely concluded that a joint which is often perfectly cool is not the seat of any active inflammatory process.

Stiffness.—This symptom must be carefully studied in any case in which nervous mimicry is suspected. It is characterised, in the first place, by the exaggerated degree in which it is often present; for while motion in a joint affected with inflammation is invariably impaired, it is as a rule, at least in the earlier stages, not completely lost, and its defect can be ascertained to be located either in the joint itself or in the muscles immediately surrounding it; while in nervous mimicry it is noticed often that the joint is stiffened by the firm contraction of all the muscles of the limb. The position, also, in which the joint is found is often very suggestive. When real disease is present the joint is placed in

the position of greatest ease (p. 420); but in nervous mimicry it is often either rigidly extended or rigidly flexed, or fixed in some other posture which would certainly tend to increase the pain of real disease. In Case 1 the limb was maintained in a position of strong flexion. In other cases where the knee is affected the limb is maintained in a position of rigid extension, a posture which in itself is almost enough to exclude the presence of any inflammatory disease. I have notes of one case in which the elbow was thus completely extended, and of another in which, after a slight sprain of the ankle, the foot was held in a position of extreme talipes equinus. In another, the thigh was so strongly adducted that the limb was apparently shortened (p. 422) to the extent of four inches. A further point sometimes observed in these cases is that the posture in which the limb is held is not constant. In a patient who had mimicry of hip-disease, the limb was found sometimes apparently shortened, and then a few hours later apparently lengthened. In another, in which the ankle was concerned, the foot assumed at different times almost all the various forms of talipes, being turned sometimes in one position and sometimes in another. Lastly, the stiffness which depends on mere nervous disorder not only completely disappears when the patient is under an anæsthetic, but also, to a large extent, during sleep. *7/2* *about* *1-2* *traces* *1.* In the more severe forms, however, rigidity remains during sleep, though it may be somewhat less marked than when the patient's attention is directed to the limb.

Wasting.—Here, again, is a sign that demands careful consideration. In any case of inflammatory joint-disease, except in the most incipient stage, or when the affection is very slightly developed, atrophy is present; while in many cases of neuromimesis it is entirely absent. Thus, this symptom is often available

for drawing a distinction between the two conditions. Yet it cannot be always depended upon for this purpose, for there are many instances of mere nerve-disorder in which some, and it may be considerable, muscular wasting is present. In any case of doubtful diagnosis, therefore, it will be important to notice whether, and in what degree, atrophy has occurred. If, notwithstanding the presence of pain, stiffness, and lameness, there is no wasting, the latter point may be taken as constituting a strong presumption that the affection is only nervous. Especially may this view be held if the joint is habitually cold, and if no swelling of the joint is found after careful measurement.* If, however, wasting is present, no hasty conclusion that the case is one of organic disease must be formed, but all the other symptoms, as well as the age and general characteristics of the patient, must be taken into account. These last-mentioned points should always be allowed their full weight; for nervous mimicry is most commonly met with in female patients, in whom there is often a history or some present evidence of hysteria, neuralgia, or some other form of nervous disorder. It is often seen, also, in young male subjects who lead sedentary lives, have a highly-strung nervous temperament, and are frightened and fanciful about their health. In one instance a surgeon, aged about 26, consulted me with a suspicion that he was developing hip-disease after a railway accident. He walked very lamely, and the muscles of the thigh were maintained in a condition of contraction, the limb being in a position of slight flexion and adduction. There was, however, no trace of wasting or swelling, and he had no pain or stiffness at night; but he complained of intense suffering on even the slightest touch, and would not tolerate the gentlest attempt to move the limb. Suspecting the nature of the case, I

* This test cannot, of course, be used for shoulder or hip.

had him placed under the influence of ether, and I then found that the joint moved with the most perfect freedom in every direction. As soon, however, as the effect of the anæsthetic passed off, muscular contraction returned. He recovered quickly under change of air, and when he was strongly assured that no disease was present.

A group of cases, the diagnosis and treatment of which may present considerable difficulty, is formed by instances in which **structural joint-disease and hysteria or neuromimesis occur together**. Such a combination is often met with in female patients between twelve and thirty, and sometimes also in males of a similar age. In such cases a mistake in diagnosis may lead to very unfortunate results. Error can only be avoided by bearing in mind that incipient organic disease is apt to be obscured by hysterical symptoms; and by very closely investigating each case, and repeating the examination a few days later, so that a mature conclusion may be formed. Until doubt has been set aside, the patient should be treated as if organic disease were known to be present. The following example came under notice a few years ago: A girl, aged 19, complained of pain in her knee, and said that she was unable to walk on the limb. On examination, the joint presented a natural appearance, except that it was very slightly puffed on either side of the ligamentum patellæ. The limb was fully extended. There was slightly increased heat of the skin over the joint. The patella was freely movable. On the slightest touch of the surface the patient complained of severe pain, and when an attempt was very gently made to ascertain whether the limb could be flexed she became strongly hysterical. It was found that during sleep the knee was often considerably flexed, but that when she was awake it was always extended. When asked to walk

on the limb she became agitated, and instead of attempting to bear weight on the leg she scarcely touched the ground with her heel, but threw herself on the other limb with a violent jerk that must, as it seemed, have inflicted pain on the suspected knee, were it really the seat of disease, but this sudden movement did not appear to hurt her. She was pale and anæmic, and her menstruation was irregular and painful. There was no doubt that this patient was strongly hysterical, and at first her symptoms were ascribed to this condition. But on further investigation it was noticed that the muscles of the thigh were wasted and flabby, that there were night-startings of the limb, that the slight enlargement of the joint was due to pulpy thickening of the synovial membrane, and that when the patient was under the influence of ether, although I could bend the joint without force, some intra-articular adhesions were felt to give way. Moreover, after the bending, although no violence was used, the joint became painful, hot, and swollen.

On a review of all these circumstances it was believed that, though the patient was plainly hysterical, the condition of the joint depended on organic disease. The limb was therefore placed in leather splints, and the patient was advised to keep it at complete rest. On her leaving the hospital, however, as I afterwards learnt, she discarded the splints and got about as well as she could. Six months later I saw her again, and found her suffering from advanced tuberculous disease of the joint, indicated by considerable swelling, flexion, heat of the surface, and commencing displacement of the tibia backwards and outwards. Two years later the limb was amputated at another hospital.

In this group of cases the danger is, that, finding the patient is hysterical, we may overlook the fact that behind this condition organic disease is present. The

important point, however, is to make the diagnosis turn, not on the detection of hysteria, but on the question whether the symptoms of organic mischief can be absolutely excluded. In the case just related it was evident that the patient was very hysterical, and the fact that the limb was kept fully extended, the extreme sensitiveness of the skin over the joint, and the way in which she threw herself about when she attempted to walk, all at first sight pointed to hysteria alone. But, on the other hand, the considerable wasting of the muscles, the startings of the limb at night, and the distinct, though slight, swelling of the synovial membrane, formed a combination of symptoms which, though each was slight in itself, raised a strong suspicion of organic disease ; and this was converted into a certainty when, during the examination under ether, adhesions were felt to give way, and when, afterwards, the joint became swollen, hot, and painful.

Treatment of hysterical joints.—This must be general and local. General treatment should comprise means for restoring or improving the health. Iron and other tonics must be given if the patient is anæmic, and irregular menstruation must be corrected according to rules set out in standard works on the diseases of women. Plenty of fresh air, and any exercise that can be taken, should be insisted on, though the latter should fall short of fatigue. The patient's mind should be diverted, as far as possible, from her malady, and her attention occupied by pleasant surroundings. She should be strongly assured that there is no serious disease of the joint, and be given to understand that her recovery is certain to take place. I have always observed that the best course is to convey the impression that there can be no kind of doubt on this score. This attitude will strongly encourage a patient who (as many do) really wishes to recover ; while in the case of patients

who wish to pose as interesting invalids, it affords little upon which they can cultivate their inclinations and morbid fancies.

Local treatment consists in the use of warmth, for hysterical joints are usually cold. The part should be covered with flannel, and hot-douching morning and evening is often of service. Any abnormal position which the limb may have assumed should be at once corrected, and a splint should be applied to prevent its return. Often an anæsthetic will be required to ensure the necessary muscular relaxation, and plaster-of-Paris applied in the manner described by Mr. Croft * forms a convenient retention-apparatus. It is often advisable to place the limb, while the patient is under the influence of ether, in the position opposite to that which it has assumed. This has the effect of tiring out the muscles that are at fault. The joint should not, however, be maintained in a rigid position for more than about a fortnight. After this period it should be shampooed, and douched with hot water, and electricity should be regularly applied once or twice a day. In many cases this form of treatment has seemed of much greater efficacy than any other that has been used. Many patients improve steadily when they can be induced to practise movement of the joint, with the assistance of a nurse or attendant, who combines passive motion with that which they are themselves able to effect.

In some cases the distorted condition has been due to paralysis of one group of muscles and the unopposed contraction of their antagonists. The treatment must consist in frictions and shampooing, combined with the use of faradic electricity, to the paralysed group of muscles, the joint in the meantime being supported in its normal position by a splint.

* *Lancet*, 1878, i. 819

CHAPTER XXXIV

INTEROSSEOUS PRESSURE IN JOINT-DISEASE, AND THE DANGER OF PRODUCING IT BY SURGICAL APPLIANCES

ALL will accept the general proposition that rest is essential in the treatment of inflammatory diseases of the joints. Yet there are some points which require to be insisted upon in order that this principle may be adequately carried out. The first relates to the injury produced by reflex contraction of the surrounding muscles. This reflex contraction is present in the case of all the articulations. In the majority, however, it is only slight, and sufficient merely to secure more or less fixation and protection of the affected joint. Neither in the shoulder, the elbow, the wrist, nor the ankle does it become excessive, so as either to lead to deformity or produce pain. All these joints when first attacked are placed in their respective positions of greatest ease, and those positions are maintained undisturbed by muscular spasm through even long periods of active disease. In disease of the shoulder the arm remains at the side; the elbow is kept at an angle of about 120° ; the wrist is slightly dropped; the ankle is fixed in a position of slight talipes equinus. Both the hip and the knee, however, offer a strong contrast to all these instances. They are liable to the influence of constant, and often violent, spasm in the surrounding muscles, which frequently leads to severe suffering and to irremediable deformity. Little can be said in explanation of this tendency to excessive contraction in the

muscles lying round the hip and the knee, but it is one of the main elements that have to be dealt with in the treatment of these two joints, and one which asserts its influence in several different ways.

To secure rest for a diseased joint, all its component structures must be taken into account, and the different sources of disturbance must be kept in view. The synovial membrane must not only be defended from mechanical disturbance by movements of the joint which would have the effect of dragging upon or compressing its swollen processes and fringes, it must also be relieved, as far as possible, of its function of secreting synovia; while if it has become distended by effusion, appropriate means must be taken to remove this condition. The articular ends of the bones must, in the same way, be relieved of their ordinary functions of sustaining the pressure to which they are exposed, not only when they are engaged in bearing the weight of the body, but also during muscular action. The latter form of pressure is, of course, well known to every anatomist and every surgeon. The tibia, in the case of the knee, for example, is a lever, acted on by the surrounding muscles, and having the condyles of the thigh-bone as its fulcrum; and whenever the muscles contract, so as to move the tibia, its upper end is pressed against the femur. Hence, to place the knee-joint at rest, it is necessary not only to protect the synovial membrane from disturbance, and to prevent the patient from bearing weight on the limb, but also to remove interosseous pressure—that is, the pressure of the tibia against the femur which results from muscular action.

Rest both from the weight of the body and from the pressure attending muscular action is secured for a healthy knee-joint for a considerable period in every twenty-four hours. During sleep, and in many other circumstances, all weight is removed, the limb is placed

in the semiflexed position, all the ligaments and all the surrounding muscles are relaxed, and the bones touch, without pressing upon, each other.

The conditions, however, under which a diseased joint is placed are widely different. Pressure depending on superineumbent weight may, it is true, be removed by posture. But, in consequence of reflex irritation, the muscles are kept in a state of contraction, which in the hip and knee is often so spasmodic and so violent that it is attended with extremely painful startings of the whole limb. The force with which the muscles act exceeds normal contraction as pain exceeds natural sensation. Its amount is indicated by the suffering it causes when, as is so often the case, the slightest movement of the limb, or light steps across the floor, bring on a succession of spasms that make the patient cry out with pain; while such violent contractions occur the moment he dozes off that, though he has passed through hours of distress, his chief anxiety is to keep himself awake. In these circumstances the articular ends of the bones are not only deprived of the usual respite from pressure which constitutes their physiological rest, but, diseased as they are, and therefore so much the more in need of relief and protection, they are exposed hour after hour, or even week after week, to an amount of pressure that, in consequence of the power and suddenness with which the muscles act, is in many cases greatly in excess of that to which they would be exposed, except on very rare occasions, in the condition of health.

Any scheme for treating the hip or the knee, therefore, must include a provision for the relief of interosseous pressure. There are at present two principal methods by which this may be attempted: (1) The joint may be placed in some form of rigid apparatus which prevents movement, and under the influence of

which muscular spasm will gradually subside. In all the joints except the hip and knee, and in many instances in these also, this method is efficient, and leaves nothing to be desired. Improvement is immediate, and the subsequent progress is in the majority of the cases satisfactory. (*See Diseases of the Elbow, Knee, etc.*)

(2) Weight-extension may be employed. It is not too much to say that the introduction of extension by means of the weight and pulley has effected a revolution in the treatment of many forms of disease of hip and knee. Instances are constantly to be met with in which, by the help of this method, patients previously in severe suffering, and presenting such marked symptoms as night-startings, high temperature, and wasting, are at once relieved, and soon rapidly improve. This fact is so well known at the present day that it is scarcely necessary to confirm it by cases. Yet the contrast between two instances which I will give may be taken as an illustration of it.

Sir Benjamin Brodie * thus relates the case of a gentleman who had hip-disease resulting from a fall from his horse :—

“ One morning after the application of leeches he had a paroxysm of violent pain, attended with spasmodic action of the muscles of the thigh. The pain during this attack was so excruciating that, to use his own expression, he wished for immediate death. He took no less than one hundred and fifty drops of laudanum before he obtained relief. From this time, however, he was never wholly free from pain, and he was also liable to repeated attacks of most intense suffering, attended with violent spasms of the muscles of the thigh.” He died a few months later (after suppuration had occurred) of phthisis. Brodie believes that the spasmodic condition of the muscles depended on the irritation produced by the formation of pus deep in the thigh, causing pressure on the branches of the anterior crural and obturator nerves, which he found were in close relation to the sac of the abscess. But, however produced, this condition would,

* “ Diseases of the Joints,” p. 121, 5th ed., 1850.

no doubt, have been relieved had the muscles been controlled pending the evacuation of the abscess by the continuous application of a sufficiently heavy weight to the limb.

I attended a patient, aged 23, whose right hip-joint was diseased after an injury in hunting. When first seen, he was suffering so severely with spasmodic action of the muscles of the thigh that he was afraid to go to sleep. His temperature varied from 102° to 104° ; he had profuse sweating, and was wasting quickly. A weight of seven pounds, increased in two days to fourteen pounds, soon relieved him (p. 444), and in the course of a week the spasms became very slight and occurred not more than once or twice during the night. They subsequently ceased to trouble him, and though an abscess formed in the thigh, and rapidly attained a large size, he had no more severe pain, and ultimately recovered with ankylosis. The efficacy of extension in relieving spasm in this case was also shown by the fact that if the weight was removed, even for a moment, painful muscular contractions immediately returned; while on one occasion, when it became accidentally detached during the night, the patient suffered severely for nearly twelve hours, though the extension was reapplied with the shortest possible delay.

The experience of every day shows that, setting aside the pain produced by the formation of an abscess, which, however, is often very slight, the severe suffering attending disease, whether of the hip or the knee-joint, is due almost entirely to **interosseous pressure from muscular spasm**. When I was house surgeon in 1862 at the Hospital for Sick Children I often made the following observation: Children who on admission presented marked signs of hip-disease, including startings of the limb and frequent night-screams, were placed in bed with no other treatment than weight-extension in the manner described at p. 441 *et seq.* In almost every instance the acute symptoms at once subsided. When the children had become free from pain—usually in two or three days—I removed the weight while they were asleep, and found that they became restless and soon awoke. They, however, fell asleep again when it was replaced.

Yet there lies at the basis of the successful application of weight-extension a principle which is frequently overlooked, with the result that, instead of acting so as to relieve interosseous pressure, by drawing the surfaces out of abnormally close contact, extension has exactly the opposite effect, for it brings the articular ends still more firmly together. If the weight is attached to a limb that is in a position of extension (to the leg, for instance, when the knee can be straightened), its tendency is to draw the joint-surfaces apart.* In the majority of cases, however, in which the weight is used, the joint is fixed in a posture of flexion, and does not admit of extension. Now, if the weight is applied in the usual manner, when the limb is flexed, it will be seen by looking at Fig. 87 that the force called into play is that of leverage of the second order. The traction-weight attached to the foot is the *power* acting on the lever formed by the tibia; the *resistance* to be overcome is in the contraction of the hamstring muscles and the ligamentous structures at the back of the joint; the *fulcrum* is constituted by the condyles of

* It is often said that the surfaces of a healthy joint do not admit of separation. The degree to which separation is possible is, no doubt, very slight, and no more than is sufficient to permit the various natural movements. If, however, traction is made on one of the fingers when it is extended, it will be seen that the first phalanx can be distinctly drawn away from the head of the metacarpal bone, so that the capsule is pressed into the interval by the weight of the surrounding atmosphere. It will also be found that the phalanx can be thrust back into contact with the metacarpal bone with a concussion that can be plainly felt, and often plainly heard. The wrist, also, in most people, can be so far "drawn out" that the bones return into contact with a very appreciable recoil. But the effect of weight-extension is not so much to draw the surfaces apart, so that there is an interval between them, as, by removing muscular spasm, to prevent them from being pressed too firmly together, and constantly maintained in that abnormal condition.

the femur. The effect of the traction-weight is, therefore, to bring the head of the tibia into firm contact with the condyles of the femur—to produce by leverage interosseous pressure.

In the same way, in the case of the hip-joint (see Fig. 88), the weight attached to the foot acts on the femur as the power tending to overcome the resistance

offered to extension of the thigh on the trunk by the rigid psoas and iliacus muscles inserted into the lesser trochanter.

If the parts are examined when the weight has been applied it will be

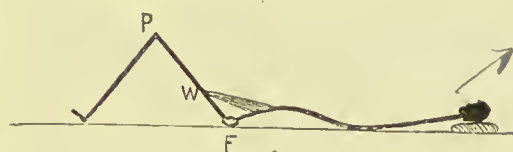


Fig. 88.—Posture of the limb in hip-dis-ease in which weight-extension acts as leverage.

P, Pulley; w, weight; F, fulcrum.

found that the limb has come down into the horizontal position, while the pelvis has been rotated so as to

produce curvature of the lumbar spine forwards, as in Fig. 89. This change in the position of the limb, however, does not alter the force that is being employed. The force is leverage still, and interosseous pressure is still in action. In



Fig. 89.—Weight-extension acting as leverage in hip-disease.

P, Pulley; w, weight; F, fulcrum.

weight—in other words, to secure that it shall act by extension instead of by leverage—it is necessary to proceed in the following way. In the case of the

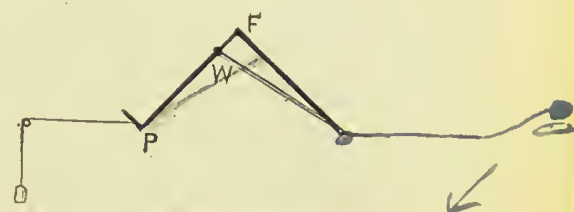


Fig. 87.—Weight-extension acting as leverage in the case of the knee.

P, Power; w, weight; F, fulcrum.

knee, the thigh must be flexed upon the trunk and fixed, and the extension must then be made in the long axis of the leg. Fig. 90 represents a suitable form of splint for use in disease of the knee-joint when weight-extension is required. It is so arranged that the angle can be gradually increased (i.e. the leg gradually lowered)

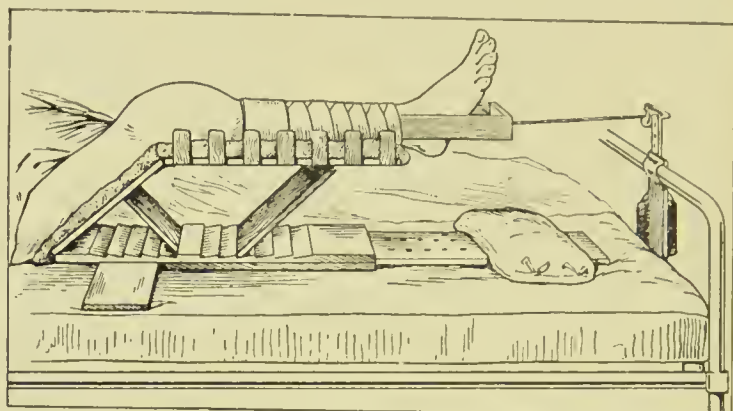


Fig. 90.—Marsh's knee-splint. Extension and counter-extension. The splint can be arranged to suit any degree of contraction. As the muscles become relaxed and the deformity diminishes, the splint is gradually lowered. Counter-extension is maintained by the weight of the body combined with the pressure of the splint against the thigh. The foot of the bed is raised on blocks to assist counter-extension, and the splint is kept stationary by sand-bags.

as muscular spasm gradually diminishes under weight-extension.

It seems advisable to draw particular attention to this subject. Here is a great principle in the treatment of diseases of the joints to which everyone freely subscribes ; the principle, namely, of removing interosseous pressure. Yet there can be no doubt that, though we possess adequate means for carrying this principle into effect, there is some danger that the method may be used in such a manner as to produce exactly the opposite result. I have seen many cases in which weight-extension, applied as in Fig. 88, has had the effect of

increasing pain, and has therefore been discarded as a failure. In these cases, however, when the limb has been arranged as in Fig. 90 (p. 520), and the weight has been reapplied, pain has been at once relieved and the efficacy of the treatment has been fully vindicated.

But weight-extension is not the only method at present in use by which interosseous pressure may be inadvertently produced. Take next the cases in which a joint is straightened under an anæsthetic.* In this proceeding, the knee being taken as a convenient illustration, the tibia is used as a lever to overcome the resistance offered by the contracted hamstring muscles and the various ligamentous structures about the joint, and the head of the bone is made to bear forcibly against the condyles of the femur.†

This operation, as all who have performed it are aware, often produces considerable pain, and not rarely a good deal of subsequent heat and swelling—symptoms in part, no doubt, due to disturbance of the soft structures of the joint and to the rupture of the adhesions, but also often, in great part, to the injury which the articular ends of the bones have inflicted on each other in the relation of lever and fulcrum which they have been respectively made to bear. Nor is the mischief at an end when the straightening itself is

* As surgery improves, forcible movement is being employed with greater discrimination than formerly. It is rapidly falling into disuse. As to the straightening of joints that are or have been seriously diseased, *see* p. 535.

† It will be observed that, while the muscles surrounding the knee and other joints almost all act on levers of the third order, it is the second form that is used when we resort to forcible straightening. It will be observed, also, that while the muscles act at a great disadvantage as to power, owing to the fact that they are inserted so near the centre of motion that their leverage is very short, in forcible straightening the leverage employed is much more powerful, for the lever is formed by one of the long bones grasped at its farther end.

completed ; but pressure is maintained when the limb is placed upon a splint, with the recently extended muscles and ligaments still in a tense and resisting condition. The continuance of pressure is shown by the pain which persists, in some instances for many days or even for some weeks, after the operation.

Another case in which intercrossous pressure is produced in the treatment of joint-disease is the general one in which any kind of apparatus, working by a screw, is used for straightening a contracted limb. The best example that can be given of a large number of appliances of this kind is the common back-splint, working with a screw, however arranged, for extending the knee-joint. In this apparatus the leg-piece, as it is made to straighten itself on the thigh-piece, plays exactly the part of the surgeon's hand when he grasps the tibia and forcibly extends it. In both cases alike the tibia is a lever resting against the condyles of the femur as its fulcrum, and the resistance lies in the contracted hamstring muscles ; and while, in the one case, the force is applied by the hand of the operator, in the other it is applied by the screw tending to carry the tibia towards an extended position. Instruments acting on the same principle of leverage, and intended for the treatment of deformities, both of the hip- and knee-joints, are to be found in every illustrated work on orthopædic surgery and in every catalogue of surgical appliances. Many of them are very powerful, and are described as competent to overcome any resistance short of that due to bony ankylosis. I will not deny their power. I am sure, however, they often do very great harm. For contraction of the elbow, also, similar appliances are in use. They consist of an arm-piece and a forearm-piece moving on each other at the elbow, under the action of a screw.

Probably all who have employed it have been im-

pressed by the unsatisfactory effect produced, in cases of disease of the knee, by the kind of splint I have alluded to. The contrast between the result of using this kind of appliance, which creates, and the result of weight-extension, which removes, interosseous pressure was well shown in the two following cases: A woman, aged 27, was in St. Bartholomew's Hospital for the treatment of acute inflammation of the knee-joint of six weeks' duration, following confinement. As the joint was bent to within a right angle, a back-splint was applied for the purpose of fixing it and keeping it at rest, and every day the screw was slightly turned in order to straighten the leg upon the thigh. This treatment, however, not only failed to relieve the pain of which the patient complained, but had the effect, especially when the screw was turned, of increasing it to such an extent that she begged to have the splint removed. She was, in fact, quite unable to sleep, on account of violent and nearly incessant startings of the limb, which occurred as soon as she dozed off; her temperature was 103° , and she was losing flesh so rapidly that it seemed likely amputation would soon be called for. The limb was now placed in the position shown in Fig. 90, and a weight of seven pounds was applied. The result was almost magical. The pain and startings were at once almost entirely removed; her temperature went down to 100° ; during the following night she slept for several hours without waking, and said next morning that it was the best night she had had since her knee was attacked; her appetite and strength returned, and within a week the joint had ceased to pain her, and was steadily passing into a position of extension. She left the hospital two months later with the limb straight and enclosed in leather splints.

A boy, aged 9, was in the Hospital for Sick Children with a contracted and painful knee. The joint was hot

and swollen, the skin over it was tense and shining, the leg was flexed at less than a right angle with the thigh. The limb was placed on an iron back-splint fixed at a corresponding angle, and working with an extension screw. This appliance failed to give relief. On the contrary, at the end of a fortnight the pain and heat of the joint were increased, and the boy always complained more after the extension screw had been turned. The limb was now placed as in Fig. 90. The effect was, as in the other case, very striking; the boy was at once much easier, and he slept well. Within a fortnight pain had entirely ceased, the limb was approaching complete extension, and heat and swelling were both subsiding. In six weeks he went to the convalescent branch of the hospital, free from pain, and with the limb enclosed in splints, in a position of nearly complete extension.

It may be objected that in many cases the unfavourable results I have mentioned of the use of splints for extending joints are not observed; that position is corrected readily and by a painless process. This is, no doubt, true. Such examples are instances of synovial disease, generally slight and not of long standing, in which the articular ends of the bones are normal, and can bear the pressure which the apparatus involves. The pressure, nevertheless, exists, and in the majority of cases is certainly prejudicial.

This interosseous pressure is mischievous not only in its immediate effect on the ends of the bones, but because, by giving rise to reflex irritation, it tends to maintain and to aggravate spasm in the surrounding muscles. Indeed, these two conditions of interosseous pressure and muscular spasm act and react on each other, and so concur to promote the advance of the disease. The method of weight-extension acts in a radically different manner. It has a direct tendency to fulfil the two main indications of treatment. It

tends to separate the articular ends, and by its constant and steady action it tires out the muscles, so that they soon pass into a condition of repose.

The numerous class of appliances for straightening contracted joints upon the principle of leverage are open to a further objection. The knee will again serve as the best illustration. When the knee is being acted upon by the ordinary back-splint working with a screw, the head of the tibia, by pressing firmly against the femur, tends to induce reflex spasm, so that the hamstring muscles are maintained in a condition of contraction. In these circumstances they resist extension of the leg, with the result that in place of the tibia resting upon the condyles of the femur—as the end of a lever should, with a firm bite upon its fulcrum—it tends to slide upon their rounded, polished, and lubricated surface, in a direction backwards into the popliteal space. In other words, instead of the fixed point being at the spot where the tibia rests against the femur, this fixed point is placed where the hamstrings are inserted; so that the result of the use of the splint is to produce, not extension, but dislocation of the bones of the leg backwards. The effect is very similar in the hip. In cases of contracted hip the orthopædic appliance still sometimes used consists of a steel pelvic circlet, and a strong bar working with a screw, and reaching down to the knee. The essential part of this instrument is the thigh-picce, which is made to travel towards extension by the action of the screw opposite the hip-joint. In this movement it makes a lever of the femur, whose fulcrum is at the acetabulum, so that the head of the femur is pressed firmly against the upper and posterior border of that cavity. Now, in cases in which the upper border of the acetabulum and the head of the femur have not undergone absorption there will be no sliding; but if absorption has already taken place, so that the acetabulum has

become shallow, and the head of the femur has melted away, the result of the use of this instrument will very likely be the displacement of the femur upwards and backwards upon the dorsum ilii. An instrument acting on so defective a principle should not be used. Much better results will be obtained by weight-extension employed in the manner described at p. 442 *et seq.*

CHAPTER XXXV

ON BONE-SETTING

CHIRURGERY, or handieraft, began, we may well believe, in attempts to pull-in dislocated bones, to straighten distorted joints, and to restore movement to stiff limbs. In this dawn of the art nothing was known of anatomy or pathology ; it was only seen that a limb was bent or stiff, and force was employed to overcome the defect, just as it might be used to straighten a crooked bar, or loosen a rusty lock. Soon, however, the primitive operators of those early days became ranged in two groups: the mere empiries, who went straight to the point of trying what force would do; and those who endeavoured to ascertain the nature of particular cases, and the difference between one case and another—those, in other words, who cultivated pathology and diagnosis in order that they might use force with safety and advantage. The results of practice conducted on these different lines can easily be imagined. The empiries, applying force in all cases alike, and thus involving their patients in a mere game of chance, did good whenever such untempered force as they could use was appropriate, and harm whenever it was unsuitable; those who used force only when they could see a reason for doing so, and when they thought it was safe, while they did little harm, often, as their diagnosis was very rudimentary, missed an opportunity of producing a cure. In these conditions the empiries frequently had the best of it. Regular, but as yet very ill-informed, practitioners were so often beaten in their

encounters with disease that they lost credit in the public eye ; while the empirics, making the most of their cures, and not seldom laying the blame of their failures on the surgeon whose previous treatment they alleged had done all the mischief, were credited with powers that approached the miraculous. And we can understand their success, for every surgeon now well knows that instances are common enough in which pain and limited motion, resulting from sprains and other injuries, may at once be set right by even rough and unskilled movements, or, indeed, by an accidental wrench. Of this latter fact some illustrations are given later (p. 532 *et seq.*).

At the present day irregular practitioners still continue to enjoy no small reputation by curing cases which, though they are a source of great inconvenience to patients, have been passed over by surgeons as too trivial for either careful diagnosis or serious treatment. Thus, although they are much less common than they were thirty or even ten years ago, such cases as the following are still to be met with : A patient whose shoulder, three or four weeks after an injury, remains stiff and painful, as the result of the formation of slight adhesions around the joint, consults a surgeon. The surgeon examines him, and, finding that there is neither fracture, dislocation, nor inflammation—finding, in short, that there is nothing seriously wrong—prescribes rest and a liniment, and says that all will come right in time. But this is small comfort to a man who can neither dress himself nor raise his hand to his head, and whose rest is disturbed by pain in the limb. So, having waited in vain for the promised recovery for three or four weeks, or even for six months, he takes the advice of his friends, and goes to a bone-setter. The bone-setter says that the small bone of the shoulder is out, or that the “deltoid has slipped round to the

front," and forcibly overcomes the resistance to movement, with the result that the patient finds himself cured, while the bone-setter triumphantly draws his attention to the snap which occurred when the bone "went in." The conclusion from these plain facts is in the eyes of the patient, obvious enough. He has, he believes, clear evidence, with every link complete, that the surgeon has displayed great ignorance and the empiric marvellous skill, and he is never tired of relating all the particulars of his extraordinary ease. The explanation of such cases, which is very simple, is given at p. 532.

Taking much interest in manipulation as a means of surgical treatment, I have been at some pains to ascertain the manner in which bone-setters conduct their practice, and to learn in what cases it is that they succeed. Bone-setters, as would naturally be supposed, are a very miscellaneous group. Some are blacksmiths on the Cumberland hills, or shepherds in the sequestered valleys of Wales. Practitioners of this order, standing in the same relation to surgery that herbalists bear to medicine, have existed in these remote districts from time immemorial. At the other end of the scale are operators of a less unsophisticated stamp. Residing in large towns, and by many of the public thought, without unwillingness on their part, to be qualified surgeons, they equip themselves with the names of some of the principal bones and muscles, and with a few picturesque medical phrases; they procure a skeleton on which they undertake to show patients the precise nature of their complaints; they employ anæsthetics freely, and make full use of daily passive movements and massage; they apply instruments, and in spinal cases they put on Sayre's plaster-of-Paris jacket, or some other form of support. These individuals, however, are in the same position as the most homely of

their order in this particular—that diagnosis, properly so-called, forms no part of their system. They merely say that a bone, or one of the “buttons of the back” (their name for the spinous processes), is out; that some muscle, such as the deltoid, has slipped round to the front; or that the fibula has slipped round to the back. Often, if pressed for particulars, they reply, “I can cure you: what more do you want?” A well-known operator, near London, now dead, used to say, “Don’t bother me with anatomy; I know nothing about it!” and in a trial a bone-setter who was asked in open court to articulate the tibia with the fibula was unable to do so. This system of throwing all cases into a single class, and treating all alike by wrenching, though it leads to many cures, must, of course, present another side, of which the following illustrations have come under my own observation:—

A lady with a very large subperiosteal sarcoma of the lowermost third of the femur was told that her knee was out and must be put in, and all the preparations for the operation were made, when a surgeon was consulted, and the necessity of amputation was explained.

A man, aged 32, was sent to St. Bartholomew’s Hospital for an opinion about his shoulder. I found a large sarcoma of the upper end of the humerus. The patient had been told by a bone-setter, under whose treatment he had been for two months, that his shoulder was out and could be put in as soon as the swelling was reduced by the lotions that were being applied.

In a case of far-advanced angular curvature of the spine in a little girl, the “buttons of the back” were said to be out; the spine was straightened to put the buttons in, and the patient died a fortnight afterwards. I have three times been compelled to amputate tuberculous knee-joints which had been forcibly wrenched by a bone-setter to “put the bone in.”

Some cases in which the treatment does no harm are equally clear evidence that diagnosis is not a part of the bone-setter's system.

A lady with an enlarged bursa over the tuber ischii was informed that her bone was out, and the part was manipulated to put the bone in. Another who was suffering from hæmorrhoids and pain about the sacrum was told that the last bone of her spine was out, and she went through the process of having it put in.

A boy was brought to the Children's Hospital with an old sinus that was discharging near the hip. The mother stated that she wished to have this closed because then she could go back to the bone-setter, who told her that the hip was out, and that when the place was healed he would put the bone in. The case, however, was one in which the hip-joint had already been excised.

With these and similar instances before me I wished to investigate the subject a step farther, and I sent three cases to a well-known bone-setter, since deceased, for treatment. None of the three had anything the matter. The first was informed, on showing his elbow, that his ulna was out, and, having paid half a guinea for the consultation, he was told to come back in a couple of days with two guineas, when the bone would be put in. A second was told that his ankle-bone was out, and, having paid his fee of half a guinea, was instructed to come back to have the bone put in. The third received exactly the same opinion, and directions for the operation. The complaints from which patients are told they are suffering are often sufficiently alarming. A young man, suffering from slight lateral curvature of the spine, the result of inequality in the length of the lower extremities, was told that his pelvis had opened and both his hips were out.

[... Some are disposed to credit the empirics with very

skilful manipulations, as if they practised jiu-jitsu; and, no doubt, they acquire much facility in the mere handling and moving of the various joints; they know how to seize the limb with all the art of a wrestler, and at such an advantage that, *coûte que coûte*, all resistance can be overcome. Of this kind of skill many bone-setters are complete masters, but it is a skill limited to the application of mere physical force. This is their strength. Their weakness is that they do not know whether they are applying their force in a suitable or an unsuitable case, in a case of sarcoma or tuberculous disease, or in a case of simple adhesions about an otherwise healthy joint.

That the practice of bone-setters is entirely empiric and independent of diagnosis may seem an unreasonable view to those who have been benefited by their treatment. On this point, however, some evidence has been already given in Cases 1 and 2, related above (p. 530). At least, the alternative conclusion that the operators knew what these cases really were, and yet proposed to subject the patients to forcible movement, would involve a much graver conclusion. Nor can it be questioned that excellent results may sometimes be obtained by haphazard wrenchings and movements. Indeed, many cases might readily be furnished in which forcible movement, entirely fortuitous and unguided by any element of diagnosis, has suddenly produced a cure. A few examples may be shortly stated. A man, aged about 60, after bruising his shoulder and breaking a rib in a fall, was unable to put his hand on his head or to move his arm to put his coat on. Three months afterwards, as he was climbing up to the front seat of an old-fashioned omnibus, he slipped and hung for a moment by his stiff arm, which consequently was suddenly wrenched, so that his elbow was carried above his head. He was in great pain for a few hours, but

next day he found that he had recovered the free use of his limb. A woman, after a fall on her shoulder, found her arm so stiff that she could not raise her elbow from her side. One day, about a month afterwards, she slipped as she was going downstairs, and clutched the banisters. Her arm was wrenched, and, though she had severe pain for some hours, she completely regained the use of the limb. A schoolboy, aged 18, as the result of an injury some years before, had his elbow-joint fixed so that he could not extend his forearm beyond an angle of 130° . When playing, one of his companions caught him by the hand and jerked him suddenly forwards. He had severe pain at the elbow, lasting some minutes, but when this subsided he found that he had regained the power of extending his forearm, and the stiffness never returned. A patient told me the following instructive case. Many years ago, while he was at Harrogate, a gentleman was taking the waters for the relief of pain and stiffness about his shoulder, which was said to be out. While walking in the meadow in which the springs are situated, and which was then surrounded by a hedge and ditch, he was attacked by a cow. In this emergency he endeavoured to escape by taking a running jump at the hedge and ditch. In doing so, he made a spring, and involuntarily carried his arm upwards and forwards, with the happy result not only of escaping from the infuriated cow, but of "putting his shoulder in," for, from that time, he regained full power of movement. Who can doubt that this was a case of slight adhesions, ruptured by the sudden movement of the limb, or that the bone-setter would have cured the patient just as the cow did, and with as little knowledge of the condition to which the pain and stiffness were really due?

CHAPTER XXXVI

MOVEMENT AND MASSAGE

UNDOUBTEDLY a great advance has taken place since the attention of the profession was first pointedly drawn to the subject of forcible movement by Sir James Paget in 1867.* Nevertheless, though many surgeons are fully alive to the value of manipulation, there are some who are still apt to let cases escape their notice which this method would readily cure.

A main influence in checking the use of manipulation has been the impression that the force employed may often do more harm than good. Undoubtedly this is a real danger unless care is taken in the selection of appropriate cases. Here, as in so many other instances, everything turns on a proper choice of cases. And the key to this lies in the fact that when the joint itself is, or has been, seriously diseased, manipulation is generally either useless or mischievous: no amount of force can restore the structures to a condition in which they can resume their functions, while any force that is used is apt to provoke an aggravation or a renewal of disease. On the other hand, there are numerous cases in which the joint itself is healthy, or not materially damaged, but in which its movements are restricted by some abnormal condition chiefly affecting the surrounding structures, in the form of adhesions about the capsule, the sheaths of tendons, or the intermuscular connective tissue. These adhesions, although they are sufficient, by the pain they induce on movement, to prevent the

* "Clinical Lectures and Essays," 2nd ed., p. 87.

use of the limb, are as slight and as easily ruptured as are the adhesions found, post-mortem, in cases of recent pleurisy or peritonitis. It is in these cases, and in some other instances given below, that manipulation is so strikingly successful. Indeed, it may be regarded as an axiom that the good to be obtained is, in the great majority of cases, inversely proportionate to the amount of force that is required.

When manipulation is to be employed, an anæsthetic should be given for all but the slightest cases. Gas is usually sufficient. By abolishing muscular resistance, and thus enabling the surgeon to bring the greatly diminished amount of force which suffices when the muscles are relaxed, to bear directly on the obstacle to motion, whatever that may be, anæsthetics have rendered manipulative treatment an entirely different operation from the rough proceedings which in former times were so often followed by unfavourable results. Cases are frequently met with in which force that could be exercised almost with the finger and thumb, when muscular relaxation has been secured, is sufficient to restore free use to a limb that had been for months entirely disabled by stiffness and pain on any attempt at movement. On the other hand, if the joint does not yield to moderate force, the attempt to restore movement should be given up, for the inference must be that the synovial membrane has been destroyed, and the articular cavity obliterated by fibrous adhesions. Here, although the cicatrix by which the joint is replaced may be torn through, nothing but harm will be done. Manipulation, of course, can do nothing to restore the lost synovial membrane or its functions, and the lacerated cicatrix will obstinately tend to reunite, even if it does not, from the violence to which it has been subjected, become the seat of a renewal of active disease. When the supreme importance of differential diagnosis

is fully recognised, and the point is realised that in cases which are suitable for this method (and they are of almost daily occurrence in the practice of any large hospital) only slight force is required, manipulation will reach the position it deserves, and will be regarded as one of the most valuable and most indispensable forms of treatment to be found in minor surgery. It is necessary, however, to observe that a single manipulation is seldom sufficient. If left to itself, the joint will soon be as stiff as ever. Manipulative treatment must be followed by hot-douching and daily massage and exercises. The full value of these accessories has met with somewhat late recognition. In many cases they are essential to a successful result. When as the result of a dislocation the soft parts around a joint, e.g. the shoulder, have been extensively lacerated and firm adhesions have formed, a second, or possibly even a third, movement under gas may be required.

The following are the principal groups in which manipulation should be practised:—

1. Cases in which, after sprains or other injuries, adhesions have formed around a joint which is itself in a healthy state. A boy, aged 10, fell and wrenched his hip. For a fortnight he was in bed at home, lying with his knees drawn up to his chest. His mother then found that, though the pain had ceased, the boy kept his thigh flexed upon his trunk. Afterwards he was sent into St. Bartholomew's Hospital, with the suspicion that he had developed hip-disease. Mr. D'Arcy Power, then house-surgeon, found that though it was freely movable in every other direction, and though the head of the femur rotated freely in the acetabulum, the limb could not be extended beyond a right angle without severe pain. When ether was given, and I proceeded to extend the thigh, the resistance suddenly gave way with an audible tear, which I also distinctly felt, and the

limb fell by its own weight into a line with the trunk. A few days later all the movements of the limb were absolutely free and painless. Here, in the accident, a laceration of the capsule or some other of the soft parts in front of the joint had occurred, and, as the boy lay with the limb flexed, adhesions, preventing extension, had formed. These were readily separated by manipulation, and complete recovery ensued. This case affords a good illustration of all the main features of a highly important group.

At the time the chief interest lay in the diagnosis, as to which there seemed no reasonable doubt when a careful examination had been made; and once this was established, the treatment followed by mere routine. Carelessness may entail a very unwelcome change in the aspect of affairs in such cases should an enterprising bone-setter arrive on the scene.

A man, aged 45, slipped and sprained his ankle, and was laid up for three weeks. He then began walking with sticks, but was very lame. Some improvement gradually took place, but the ankle remained, month after month, shapeless from chronic swelling, the skin was tense and shining, and the joint was so weak that he could bear no weight upon it. Nine months after the injury he came to the hospital. The joint was stiff, shapeless, and "weak," but it was perfectly free from heat; indeed, it was colder to the touch than the opposite limb. The foot was in a position of slight talipes equinus. When he had inhaled gas I carried the foot through all its normal range of movement. At first I met with elastic resistance, and, as this yielded to very moderate force, I felt numerous adhesions giving way, and minute deep-seated snaps and cracks were heard. No pain followed, and the patient the same afternoon walked about the ward. A week later he reported himself as being quite well.

Many similar examples, were it necessary, could be related, but these may be regarded as typical.

2. Cases are often met with in which subacute rheumatism is followed by stiffness and severe pain (greatly aggravated on the slightest movement) about the shoulder, but in which gentle passive motion through a limited amount of rotation of the head of the humerus in the glenoid cavity, or movement of the elbow backwards and forwards, but without any attempt to raise it, shows that the articular surfaces glide smoothly on each other; in other words, that the stiffness and pain are due not to defect *within*, but to adhesions *outside*, the joint itself. In these instances manipulation, followed by massage and exercises, will usually lead to complete recovery.

A man, aged 46, came with what he had been told was rheumatic disease, of four months' duration, of his shoulder-joint, the skin over which was of a rich mahogany colour from prolonged painting with iodine. He could not move his elbow for two inches in any direction, and every attempt gave him severe pain. He could not lie on that side, and pain at night was so severe that he could obtain but little sleep. The surrounding muscles were considerably wasted. I found that when the elbow rested quietly in my hand, the head of the humerus rotated with perfect smoothness through a slight range, in the glenoid cavity, and that the elbow could be moved forwards and backwards for some three or four inches. Having thus learnt that the joint itself was healthy (free movement, though limited in its range, conclusively established this), I proposed to manipulate the limb. The mere suggestion of such a step, however, so alarmed the patient that he declined the treatment; but, getting no better, he returned a fortnight later. When he was under gas, I first rotated the humerus in the glenoid cavity to its full

normal extent, and then carried the limb through its other movements, i.e. forwards, backwards, and upwards, performing the upward motion by a series of carefully graduated short jerks. Numerous adhesions readily gave way. The patient suffered a good deal of pain for ten or twelve hours, but within a week he was able to put his coat on. Three weeks later, as some stiffness remained, he inhaled gas, and I again moved the arm in the directions in which I found resistance. In a month from this time, massage having been regularly used in the interval, he reported that he had lost all pain, and that only a slight restriction of movement remained.

A lady, between 40 and 50, had been suffering, as she was told, from rheumatic disease of her left shoulder-joint for six months. When she was first seen, her arm was fixed to her side; the slightest movement gave her intense pain, and she often suffered with such severe spasm in the muscles of the arm that she was obliged to cling to any firm object near her, in order to avoid falling down. Pain rendered her nights almost sleepless. She could use the limb only from the elbow. Finding by the indications just mentioned that the joint was sound, I manipulated the arm, under gas. Many adhesions were felt to give way. Pain was severe for some hours. Next day she said the former pain and spasm had entirely left her, though the joint felt sore. Within a week she could get her dress on, and sleep on that side, and in a fortnight she considered herself cured.

In these cases diagnosis must be very carefully made, for if an instance of progressive rheumatic disease of the joint itself is mistaken for one of adhesions around the joint, no benefit, but rather a severe aggravation of the disease, will be produced.

3. Cases in which joints have been left stiff after

acute or subacute rheumatism, or other forms of septic arthritis,* in which intra-articular adhesions have resulted. These adhesions are often slight and will easily give way, and manipulation is followed by the restoration of completely free movement. It must, however, be remembered that the adhesions which form after rheumatic or septic inflammation of a joint are sometimes so firm and extensive as to constitute complete fibrous ankylosis, so that dissection is necessary. In cases of joints which become stiff after gonorrhœal arthritis, manipulation is often attended with good results.

4. Cases in which joints remain stiff and painful after fracture in their neighbourhood. James R—, aged 28, labourer, met with Colles's fracture, and after being treated at an infirmary for five weeks was told that the fracture was repaired and was discharged. Three months later he came to the hospital, saying that he was unable to use the hand, and that he was starving in consequence. The wrist and fingers were stiff, and the muscles of the forearm much wasted. The fingers were so manipulated when he was under gas that each joint was bent, and the wrist also was carried through the full normal range of its various movements. Two days afterwards he began work, and in a fortnight had regained free use of his limb. This case represents a very numerous class, in many of which, however, the impediment to motion is so slight that movement of the joints under gas, which would facilitate the later stage of recovery, and add much to the patient's comfort, is omitted even by those who in other cases are fully alive to the value of manipulation. All would do well to follow the excellent rule laid down by the late Mr. Christopher Heath,† that our duties in a case of fracture should be considered to end, not when the bone

* See Chapter VII. † "Minor Surgery," 8th ed., p. 297.

is found to be united, but only when the functions of the limb have been, as far as possible, restored. At present patients are sometimes allowed to remain disabled for several weeks or months whose limbs might be restored to usefulness in a few days by manipulation. Nor need it be feared that this treatment will do any injury to the recently united fracture. It should not be practised until after the lapse of a month or five weeks. Then, if the limb is grasped in such a way that the fracture is supported, and if only slight force is used, the proceeding is perfectly safe.

5. Cases in which a joint after dislocation remains stiff, either as the result of extensive laceration of the surrounding soft parts and the subsequent formation of adhesions, or because the limb, after reduction, has been kept too long in a fixed condition. C. M——, aged 50, dislocated his humerus by a fall. Reduction was easily effected, and the arm was bandaged to the side in the usual manner. I first saw him nine weeks afterwards. He could not move his elbow from his side three inches in any direction; the limb ached so much at night that he could not sleep, and, if the arm was jarred, he cried out with pain. Two operations of manipulation—with an interval of a fortnight between them—and massage restored the full use of his limb, and removed all his pain.

6. In old unreduced dislocations, manipulation, especially when combined with massage, is often followed by relief of pain and by improved position and greatly increased freedom of movement. In cases of dislocation, as of fracture, Mr. Heath's rule of not only attending to the primary injury, but of relieving the patient as far as possible from the resulting impairment of the use of the limb, should be borne in mind.*

* The crippled and painful condition in which a limb was formerly allowed to remain—after fracture or dislocation—in

7. In instances in which bruised or over-strained muscles remain passive and rigid, or in which the patient is afraid to exert a strong mental effort to move the limb. Robert D——, aged 22, came to the hospital with his right knee, which he had wrenched eight weeks before, in a position of full extension, and covered with neatly applied moleskin strapping. He said that he had attended for two months at a hospital, and had applied many different lotions, but without benefit. At length the joint had been, as I found it, artistically strapped, and he had been told to rest the limb. On removing the plaster I noticed that the joint was cool and perfectly normal in appearance. Under gas it moved into full flexion with the mere guidance of the hand unaided by any appreciable force. No adhesions were felt to give way. On being told that the joint had thus been moved, the patient cautiously attempted to bend it, and, gaining courage, was able to flex it completely, and to walk freely on the limb. Next day he went out walking naturally, and said he was cured.

A lad of 18 fell from his bicycle and bruised his arm. Three weeks later I found his forearm fixed at an angle of about 110° , and his elbow stiff. The joint, however, was perfectly natural in appearance, and free from both heat and swelling. Under gas the arm moved as readily as a healthy limb can be moved during sleep, and on recovering from the anæsthetic the patient found that he had regained complete command over the part, and next day he was discharged.

8. A similarly inert condition of the muscles, requiring the same treatment, is met with in cases in which a limb has been too long maintained upon a splint.

9. Manipulation should be employed when, from consequence of adhesions is now much more rare, for splints and bandages are happily used for shorter periods, and massage is habitually employed from the first.

the history of the case, it is believed that a tendon or muscle has become displaced. A boy of 18 came to the out-patient room with his head strongly turned towards his left shoulder, and his chin elevated. He said that while washing his face and neck that morning he felt a sudden "catch" below his right ear, and his head became fixed in its present position. Any attempt, I found, to restore the head to its normal attitude gave him severe pain about the transverse processes of the upper cervical vertebræ. Believing one of the tendinous slips connected with the transverse processes had been thrown out of place, I had gas administered, and extended the head and brought it into its normal position, and also manipulated the muscular substance of the upper part of the neck with the finger and thumb. On recovering from the gas the patient reported that all his symptoms had disappeared, and, turning his head about in all directions to demonstrate the fact, cheerfully wished us all good-day.*

The following was, I believe, a very similar example, though at the time I was quite deceived as to its real nature: A. B——, aged 17, was sent with a suspicion that he had hip-disease. He was very lame, and walked with a crutch and a stick, bearing no weight on the limb. The thigh was slightly flexed, abducted, and rotated outwards. There was deep-seated pain at the back of the joint on movement, and tenderness on pressure in this situation. There was no swelling. On examination I found that the hip-joint was movable in every direction and evidently sound, and I concluded there was tuberculous periostitis of the ilium beneath the external rotator muscles. I advised blisters, cod-liver oil, and three months' rest. At the end of this time he was no better; indeed, his condition was wholly unaltered. His friends now took him to a bone-

* See "Clinical Essays and Lectures," p. 134.

setter, who, after examining him by merely passing his fingers under the waist-band of his trousers, pointed to a spot in the thigh directly in a line with, and four inches below, the anterior iliac spine, at which he said a bone was out. At the request of the boy's mother he "put the bone in" by moving the limb, a snap being heard at the moment.* The patient could now move his limb freely, and walk upon it, with only slight pain, and this disappeared in two or three days, and left him quite well. Just twelve months later, having in the interval remained quite sound, he was asked, while at breakfast, to eat some bread, and, rising quickly to do so, was suddenly attacked with his former symptoms. He had severe pain in the old spot, and felt sick and faint. The limb was locked in a similar position, and he had intense pain if he threw weight upon it. Getting no better, he was brought to London at the end of a fortnight. The limb was then stiff, slightly flexed, and abducted, and he walked with a crutch and a stick. Movement of the limb brought on very painful spasmodic contraction of the muscles, and he suffered severely at night from startings and twitchings of the thigh. There was no swelling, but pain was excessive on pressure over the neighbourhood of the sciatic notch. Having heard how he was cured before, I put the boy under gas, and moved the limb through all its natural range of flexion, extension, abduction, adduction, and rotation. I felt nothing give way, and nothing seemed to slip; but when he recovered from the gas all his symptoms had

* The snap often heard, when a joint that has long been fixed is suddenly moved, is pointed to by bone-setters as a plain demonstration that the bone has gone in. These snaps, however, are not due to the concussion of two joint-surfaces as they are returned into contact, but, on the contrary, to the separation of surfaces which have become stuck together by inspissated synovia. Many persons can make their fingers crack by pulling at them till the joint-surfaces suddenly separate.

disappeared. He could move his limb freely, and in a few days had lost all his lameness and pain. He has had no relapse. This case seems a very instructive one. Looking back on it, I think there cannot be much doubt that it was an instance in which one of the external rotator muscles had slipped out of place.*

Probably, however, the instances in which a joint is disabled by displacement of surrounding muscles are very rare.

10. Cases of slipped semilunar cartilages and their treatment by manipulation are described in Chapter XVIII.

11. Manipulation, with the strong mental impression it produces, is a very good method by which to treat cases of so-called hysterical contraction of the joints, such as the following: A girl, aged 14, who had fallen and wrenched her limb, was brought with her knee so tightly flexed that the heel touched the tuber ischii. Feeling sure, after careful investigation, that the contraction was due merely to neuromimesis, I manipulated the limb as described at p. 535, and complete recovery followed.

A servant, aged 17, after she had accidentally pricked her third finger, had kept it tightly flexed on the palm for two months, and protested that she could not straighten it. Seeing there was nothing the matter, I pretended to pass electricity through it by pressing two sponges in holders (but not connected with the battery) upon it. She immediately straightened her finger, and was quite cured. Although movement under gas was not the method adopted in these two cases, they belong to a group in which that treatment is highly efficacious.

* In Sir James Paget's "Clinical Lectures and Essays," reference is made to the displacement of tendons (pp. 88, 469). Want of space forbids me to follow out this subject in the present work; but see "Clinical Essays and Lectures," by the present writer.

This subject might be discussed at much greater length, but I can only offer a few remarks as to the symptoms and general aspect presented by cases in which the surgeon should practise manipulation.

The first step must be to ascertain that the joint itself is not at the present time diseased, and that it has not at any former period been the seat of disease by which the structures composing it have been seriously impaired. A conclusion on this point must be drawn from the history of the case, and a very careful examination of the part in respect to the amount, character, and disposition of the swelling, and as to the degree of movement. Another highly material point is whether the joint is hotter than normal. Joints that are suitable for manipulation are either free from abnormal heat (many are abnormally cold and the circulation of the skin is sluggish, so that the skin is of a dusky-blue tint), or, if any heat follows exercise, it quickly subsides with rest.

The absence of the evidences of disease in the joint, together with the fact that the limb is nevertheless disabled, should induce the surgeon to resort to manipulation. In many cases in which, though a full diagnosis of the exact condition present could not be arrived at, serious disease of the joint could be excluded, I have seen manipulation produce immediate recovery. This was notably so in the case of A. B—— (p. 543). At the time I manipulated the limb, although it was clear that his hip-joint was sound, I was quite unable to say to what his symptoms were due.

A man, aged 28, whose ankle was stiff eight months after a severe sprain, came to the hospital in 1880. The joint was manipulated, and within an hour he could walk with scarcely a limp. Next morning he walked from Hackney to Smithfield; he reported himself cured, and had already applied for work under his former master. Six months after this, he returned to

the hospital with his ankle again out of order. He said that since the manipulation he had been at work, and had felt no inconvenience till within the last three weeks, when the joint had become stiff and weak, and so painful under any weight that he was very lame. On examination, neither heat, swelling, nor any appreciable defect of movement could be detected. He was therefore told that he had overworked the joint, and had better have it strapped and give it a week's rest. He looked disappointed, and said that his joint felt just as it did when he was laid up before, and that he believed that if it was moved again he would be all right. This was an appeal to which, as manipulation would do no harm, it seemed unfair not to yield. He took gas, and the ankle was flexed and extended. When flexion was being performed, some adhesions, which, however, were slight, and offered scarcely any appreciable resistance, were felt to give way. He left the hospital an hour afterwards, and the next morning wrote, "I have had enough travelling on my foot to convince me that it is wonderfully better, by my being able to walk without *pain* or *limping*." The adhesions which disabled the joint were so slight that I failed on careful examination to detect any limitation of movement.*

A girl, aged 12, came to the out-patient room with reported hip-disease, following a fall nine months previously. She walked on her toes, kept the joint habitually a little flexed, abducted, and rotated outwards, and complained of pain when weight was thrown on the limb. On examination I was surprised to find that the movements of the joint were perfectly free in every direction, except that adduction was very slightly restricted, and produced a little uneasiness. Rotatory movement was perfect. There was no muscular wasting, a circumstance incompatible with hip-disease of

* *Clin. Soc. Trans.*, xiii. 221.

nine months' duration. Not knowing on what the symptoms depended—whether on slight adhesions after the fall, a displaced muscle, or “hysteria”—I had the child put under ether, and moved the limb in all directions. Nothing was felt to give way. Next day every trace of restriction of motion had vanished, and the girl went out of the hospital. The symptoms did not return. I believe the case was one of slight adhesions that had formed after the fall.

Many entertain a doubt whether the stiffness left after recovery from tuberculous disease of the hip and other joints should not be treated by manipulation under an anæsthetic. I venture to say that no such step should be taken. I have never, I think, seen it succeed. The joints so treated usually become stiff again, and in many a renewal of disease is excited. The following is a case in point: A girl, aged 7, had been lame for six months after a mild attack of inflammation of the hip-joint. The limb was considerably drawn up so that the toes did not touch the ground. She walked with a crutch, but had no symptom of still-present disease. A bone-setter said her hip was out, and he put it in under chloroform. She was said to be cured. The immediate result was satisfactory, for the limb was now very nearly straight and she could walk without her crutches, though she still limped. The father told me afterwards that at the time he thought it a providential thing that the surgeon he had proposed to consult was away from home, so that his steps had been turned in another direction. In the course, however, of three weeks, pain and night-startings came on, and the child could not put her foot to the ground. A month later, when I first saw her, the limb was considerably flexed, and there was a large abscess in front of the joint. The deformity in this case might probably have been easily removed by weight-extension.



PLATE 10.—MELANOTIC SARCOMA OF THE SPINAL COLUMN.

(From a specimen, No. 483A, in St. Bartholomew's Hosp. Mus.)

PART II.—DISEASES OF THE SPINE

CHAPTER I

TUBERCULOSIS OF THE SPINAL COLUMN— POTT'S DISEASE

THE disease now to be described has, at different times, passed under different names, the chief of which have been caries of the spine, angular curvature, and Pott's disease. Of these, the term angular curvature points not to the disease from which the patient is suffering, but to one of its most prominent symptoms. Names of this order are open to the serious objection that they tend to divert attention from the disease itself, and to fix it on some single symptom or result, which is perhaps inconstant in its appearance, or which is developed only when the disease has made considerable progress, and when the period during which treatment is most effectual has passed by.

The phrase "angular curvature" should, therefore, no longer be employed as the designation of this affection. Nor should "caries of the spine" be used, for the word caries is out of place, and is rapidly becoming obsolete in the nomenclature of the present day. We are thus left with the name Pott's disease, which is in every way appropriate, and by the general adoption of which on the Continent and in America a graceful tribute has been paid to English surgery.

Pathology.—From a general point of view, there is an obvious similarity between the bones and joints of the extremities and those of the spinal column, so

far as their construction is concerned. The articular ends of the long bones consist, as do the bodies of the vertebræ, of cancellous bone enclosed in a compact layer, and the different segments in the spine, as in the limbs, are connected together by intervening joints. The main difference is that, while in the limbs the parts move freely upon each other, in the spine movement is much more limited, owing to the presence between the vertebræ of discs of fibro-cartilage. This general similarity of structure between the limbs and the spine has its parallel in the morbid anatomy and clinical history of tuberculous disease in the two situations. In the extremities, tuberculosis may originate in the articular ends of the bones, or in the synovial membrane. In the articular ends it begins (to speak of children or adolescents) either in the rapidly growing tissue of the diaphysis immediately beneath the epiphyseal plate (p. 24), or, with much less frequency, in the cancellous tissue of the epiphysis itself. In the spine, in the same way, it begins, as a rule, at the junction between the body and the upper or the lower epiphyseal plate, or it may start at any other part of the cancellous tissue of which the general mass of the body of the vertebra is formed. In some instances it starts in the intervertebral discs. A primary synovitis of the joints connecting the articular processes of the vertebræ is probably a somewhat rare condition. Yet that it does occur in the joints of the spine, as it does in those of the limbs, seems to be clearly indicated both by museum specimens and by the clinical history of particular cases. In museum preparations of tuberculous disease of the cervical spine it may sometimes be observed that, while the bodies of the vertebræ are but little affected, the articular processes and the adjacent portions of the neural arches—the pedicles and the laminæ—are deeply ulcerated,

and that evidently the main stress of the disease has fallen upon these parts. Such disease, it appears safe to believe, must have commenced in the synovial membrane by which the articular processes are surrounded, for it is very unlikely that it began in the compact bone of which the neural arches are formed.

The disease may also begin as a tuberculous periostitis in front of the bodies under the anterior common ligament.

Once established, the disease in the vertebral column runs a course very similar to that which it takes in the joints of the extremities. In the bodies it leads to a rarefying osteitis with early caseation of the tuberculous products. In childhood, when the vertebral bodies are formed of actively growing and vascular medullary tissue, very favourable to the advance of the tuberculous process, the affected structure is rapidly softened and broken down. At the same time the bodies of neighbouring vertebræ become involved, by extension of the disease; and the intervertebral discs, and the ligaments, are in great part or entirely destroyed, with the result that the column yields, and angular deformity is developed. The rapidity with which these changes may occur in early childhood is such that within three or four months from the commencement of the disease the bodies of two or three vertebræ—even as many as ten (p. 554)—may be entirely destroyed, and great deformity may take place. In subjects who are older, and in whom the external layer of the bodies and the plates of the cancellous tissue have acquired their full degree of compactness, the destruction of the bodies is a much more gradual and restricted process, and deformity is produced much more slowly and to a much more limited extent. In many instances, indeed, in the adult—especially in the lumbar region, where the vertebræ are of massive size, and

are constructed of dense bone on the surface, and within of very strong trabeculæ—no deformity occurs, even in advanced disease accompanied by suppuration.

Repair.—It is mentioned at p. 295 that when tuberculous disease of a large joint has reached an advanced stage, so that the articulation has been virtually destroyed, repair, if it occurs, is accomplished more often by fibrous than by bony ankylosis. This result depends upon the fact that the granulation-tissue, which ultimately becomes organised into cicatricial tissue, is derived largely from the remains of the synovial membrane and other soft parts, and has gradually grown inwards and insinuated itself between the ends of the bones. In the spine, however, the parts concerned in repair consist mainly of the bodies and neural arches of the vertebræ—between which the discs no longer intervene, for they have been already absorbed—and the surrounding ligaments and periosteum. Thus the structures which furnish the reparative material are mainly osseous. Such structures readily produce new bone in abundance, and one of the most striking features of the reparative process in the spinal column is the readiness with which bony ankylosis takes place. Museum specimens are numerous in which the bodies of adjacent vertebræ which have been the seat of tuberculous disease are welded together either by direct bony union or by strong buttresses and adventitious plates (Fig. 91). The neural arches, including the articular processes, are also often completely fused together. The readiness with which bony ankylosis is developed in the spine is a very favourable circumstance in connection with the repair of tuberculous disease in this situation. For if, after a considerable angular deformity had been produced, so that the upper segment of the column had been brought into a leaning position, repair was effected merely by fibrous

ciatricial tissue, the angle of deflection would become, under the influence of the superineumbent weight, more and more acute, and thus deformity would increase, just as it is so apt to do in fibrous ankylosis of the hip or the knee; but when bony union has once occurred, no further yielding can take place. No stronger proof could be brought forward of the completeness of the repair which may follow far advanced tuberculous mischief than is afforded by these examples of solid ankylosis of the spine after Pott's disease.

Sequestra.—In considering the morbid anatomy of tuberculous disease of the spine, it is important, in regard alike to prognosis and to treatment, to inquire whether bone which is destroyed perishes *en bloc*, so that massive seques-

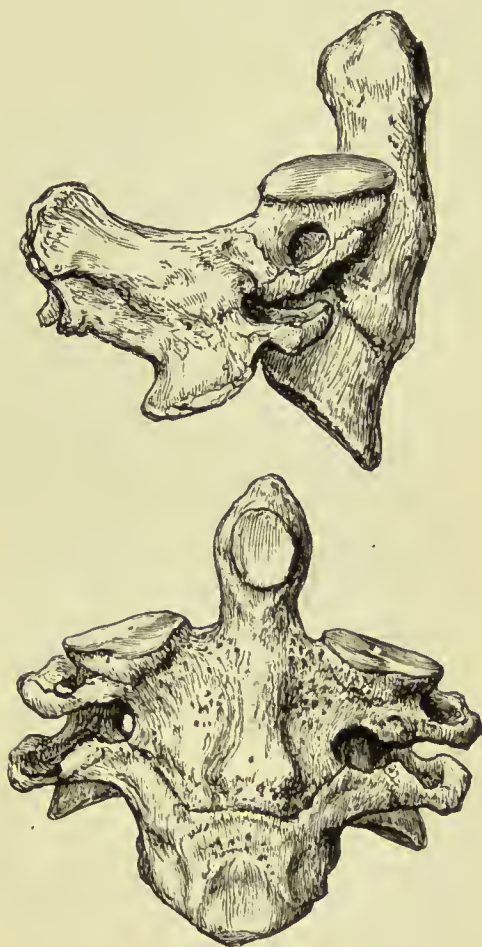


Fig. 91.—Complete bony ankylosis between the bodies and the neural arches of the atlas and axis.

(From a specimen, No. 1,078, in St. Bartholomew's Hosp. Mus.)

tra are formed, or whether it is lost by a process of molecular disintegration and absorption after it has been softened and rendered porous by rarefying

osteitis. For if firm sequestra are formed and are lodged in the column in some inaccessible situation—for instance, in the front of one of the middle dorsal vertebræ—sound repair will be indefinitely postponed, or even rendered impossible; and, secondly, if sequestra are commonly present, operative measures, when the disease is within reach, should be adopted for their detection and removal. My belief is that sequestra substantial enough to retard repair, and therefore to call for removal by operative interference, are rarely present; nor should we anticipate that they would be of frequent occurrence.

It is well known that sequestra, as a very general rule, are formed as the result of inflammation of hard or compact bone in consequence of the arrest of the circulation by effusion of inflammatory products between the vessels and the walls of the Haversian canals, by which the small arteries are compressed and the blood current is shut off. The bodies of the vertebræ, however, more especially in children—who furnish the great majority of cases of Pott's disease—are formed of soft and vascular cancellous bone, and the inflammatory process takes the form of a rarefying osteitis, in the course of which the bone is reduced, by the absorption of its earthy salts, to little more than a connective tissue matrix permeated by numerous blood-vessels. In such a tissue, when it is the area of chronic inflammation, erosion and absorption very readily occur, with the result that the affected bodies of the vertebræ are completely removed. That this, rather than necrosis in mass, is what really occurs is definitely proved both by museum specimens and by clinical experience. In museum specimens it may frequently be seen that the bodies of several vertebræ have entirely disappeared. In St. Bartholomew's Hospital Museum, in No. 1,099 four, in No. 1,110 six, and in No. 1,096 ten bodies are

lost, and yet no sequestra are anywhere present (*see* Fig. 92). Fig. 92 is a very remarkable specimen illustrating the extent to which tuberculous ulceration of the vertebræ may deform the spine without entailing bony pressure upon the spinal cord. An antero-posterior section has been made through an angular curvature

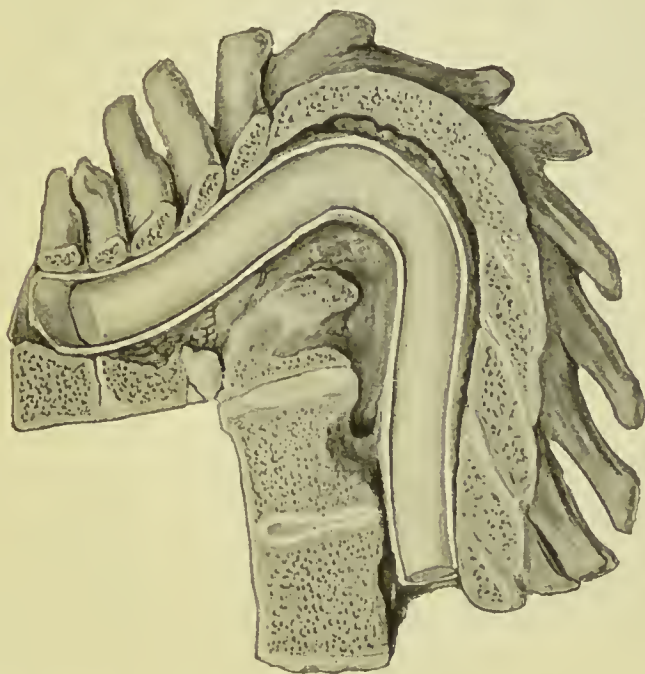


Fig. 92.—Section of a tuberculous spine, illustrating extensive destruction of the bodies, with subsequent repair, and without narrowing of the lumen of the spinal canal. Fourteen spinous processes are shown, but only the bodies of four vertebræ. An irregular wedge represents all that remains of the other ten bodies.

(From a specimen, No. 1,096, in St. Bartholomew's Hosp. Mus.)

of the spine. It shows that although along the dorsal aspect of the curve there are fourteen spinous processes, the number of the corresponding vertebral bodies is reduced to four. The remaining ten bodies are therefore represented by the irregular triangle of bone which forms the apex of the curve on the ventral aspect of the

spinal cord. But, in spite of this extensive deformity, the bony vertebral canal is actually enlarged at the site of the curve, the enlargement depending upon carious erosion of the anterior wall. The history of the patient from whom the specimen was derived showed that in the early stages of his illness he experienced paresis of the lower limbs, but that at a later date the functions of the latter were completely restored. It is clear that these pressure-symptoms must have depended upon an accumulation of inflammatory products between the spinal theca and the bony wall of the vertebral canal, the symptoms subsiding as the exudate became absorbed. The remains of this inflammatory exudate have been dissected away to expose the actual enlargement of the bony canal.

I have seen but very few specimens in which a sequestrum of any size or firmness is shown. Still, sequestra do occur; and Lannelongue* shows a well-marked example of a large one lying loose in a cavity in one of the lower dorsal vertebræ. The cases in which sequestra may form are those in which the hard texture of the bodies of the lumbar or dorsal vertebræ in adults is involved. In Fig. 93 the spinal canal is considerably narrowed by caseous material in which is embedded a small sequestrum. The specimen was taken from a boy under the care of Percivall Pott. Paraplegia had occurred and was treated by issues; under their influence the paraplegia and other symptoms subsided, and the patient recovered so as to walk with ease. He ultimately died of phthisis. The case is fully related by Savory.† But even such cases do not contravene the opinion that, as a general rule, no substantial sequestra are present. With these observations clinical experience closely corresponds. Cases are frequent in which, although the

* "Tuber. Vertébrale Mal. de Pott" (Paris, 1888).

† "Diseases of Bones," p. 326 (1849).

amount of deformity present clearly indicates that several vertebral bodies must have been destroyed, and although suppuration has come to an end, and sound repair has occurred, yet no sequestra have either come away or been removed by operative interference.

Age.—The most common age for the development of Pott's disease lies between the third and about the ninth or tenth years. This accords with the rule which obtains, with very few exceptions, in all forms of surgical tuberculosis, yet it is important to bear in mind

that no period of life, from a few months after birth to old age, is exempt. I have seen several instances in which the disease commenced in children who were less than a year old, the earliest being in a child of six months. This infant had well-marked angular curvature in the

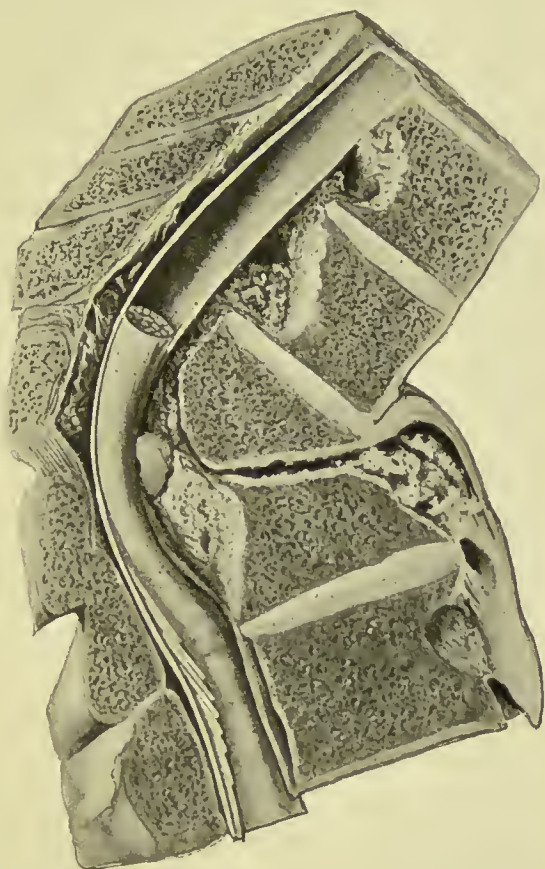


Fig. 93.—Compression of the cord by caseous material in which is embedded a small sequestrum. The bodies of two vertebræ have been completely destroyed.

(From a specimen, No. 1,097, in St. Bartholomew's Hosp. Mus.)

middle of the dorsal region. On the other hand, not only may the disease occur at any time in the course of middle life, but it may be developed in persons between sixty and seventy, or even in those who are older still. In 1893 a woman, aged 69, was in St. Bartholomew's Hospital with a sharp angular deformity of the spine in the upper dorsal region, the result of Pott's disease, from which she appeared to have been suffering for about nine months. The cases, however, which afford such striking examples of "senile tuberculosis" (p. 66) are very rare. I have myself met with only seven instances in patients over 55. The following are illustrations: 1. A man of 63 was in the hospital, with stiffness of the neck so that he could neither nod nor rotate his head; with considerable widening and bony thickening in the neighbourhood of the spines of the upper cervical vertebræ; and with pain radiating over the occiput and down the neck. His head had sunk forwards, so that his chin was nearly on his sternum, and he moved cautiously and turned over in bed with difficulty. When sitting up he supported his head with his hands, as children with Pott's disease of the cervical spine often do. No suppuration occurred while he was in the hospital. His subsequent history is unknown. 2. A healthy-looking man, aged 67, was admitted into St. Bartholomew's Hospital in 1886, under the care of Mr. Butlin. A month before he had fallen off a table, and struck his neck against a chair. This injury was followed by stiffness of the neck, which gradually increased. He was lost sight of till the following March, when an abscess formed in the neck, and Mr. Butlin opened it. About half an ounce of pus was evacuated, and the wound healed. Six months later he returned to the hospital, complaining of severe pain, increased on the slightest movement, and situated on the left side of the neck and head. Later, other abscesses

formed and were opened, and a collar to support the head was applied. Mr. Butlin showed me this patient on two occasions, and there seemed no doubt that he was suffering from Pott's disease.

Diagnosis.—It has been remarked (p. 387), in regard to hip-disease, that while diagnosis in the majority of advanced cases is perfectly easy, in many early cases, and in some instances of disease of long standing, it presents difficulties which can only be overcome by the exercise of much care. The same is true in respect to tuberculosis of the spine. Yet the formation of a correct opinion is, it is needless to say, of the greatest importance, for otherwise either early disease will be overlooked, or patients will be submitted to a long period of treatment for disease which does not exist. Here also, as in hip-disease, the particular symptoms vary considerably in different cases. It is therefore necessary to scrutinise every point of evidence, both positive and negative, that is available.

Symptoms.—1. *Pain.* This varies widely in different cases, both in its form and the degree of its severity. Sometimes pain is constant, and more or less severe, either at the seat of disease, or radiating to more or less distant parts. In some few cases it is paroxysmal, and resembles severe cramp; in others it is slight in its amount, and is suggestive only from the situation in which it is felt, and its combination with other symptoms. Again, it is very important to remember that in some cases it is completely absent during the whole course of the disease. In disease between the atlas and axis, pain is referred to the occipital region, over the distribution of the great occipital nerve. Pain in this situation, if it is persistent and associated with any stiffness of the neck, or altered manner of carrying the head, must always raise a suspicion, not to be lightly dismissed, that tuberculous disease is present. This

has often proved to be the true explanation of cases which were at first regarded as instances of wry-neck of muscular origin, or of some rheumatic or nervous affection. In disease situated in other regions of the spine, pain, when it is present, is felt either locally, or in those areas to which the sensory nerves that leave the cord at the level of the disease are distributed—over the shoulders and in the arms; round the sides of the chest or the abdomen; in the middle line in front; over the back and sides of the pelvis, or in the lower extremities. Pain, except when the great occipital nerve is involved, is very seldom situated *above* the level of the disease. If a patient complains of pain above the suspected spot, the presumption is either that the spot which is for the moment under suspicion is not the real seat of disease, which on examination will be found at some higher level in the spine; or that the case is not one of Pott's disease, but one in which the pain is of nervous origin, or due to muscular fatigue. A dental surgeon in large practice, who was engaged in the treatment of patients for seven hours a day, believed that he had Pott's disease. He had a tender spot over the tenth dorsal spine, and constant pain in the upper dorsal region, and about the shoulders. He was the more apprehensive as there was a marked history of tuberculosis in his family. The spine, however, was perfectly movable, and there was no pain below the level of the tender spot. A fortnight's rest removed all his symptoms.

In his classical Lectures on Rest and Pain, Mr. Hilton lays stress on the point that the pain which attends disease of the dorsal or lumbar spine is almost always symmetrical, and he relates a case in which, in a patient complaining of something wrong in his back, he was led to believe that, as the pain (in the course of the fourth dorsal nerve) was on one side only, and not symmetrical,

the disease was one-sided. This view proved to be correct; for on tracing the fourth dorsal nerve backwards, he detected an aneurysm. I have, however, often met with instances of Pott's disease in these regions of the spine in which pain was entirely limited to one side. Nor, with deference to Mr. Hilton, is such limitation difficult to explain. Pain, in Pott's disease, may be unilateral either because, as absorption of bone goes on, two adjacent vertebræ cave in, and become altered in their relation to each other in such a way that, of the pair of nerves issuing from the intervertebral foramina, one—say, the right—is pressed upon, while the other escapes; or the same pressure-effect may be produced by closely packed inflammatory exudation, or by one-sided psoas abscess. There was sent to the hospital a boy of 10, who, having lameness, flexion and abduction of the thigh, pain in the knee, and muscular wasting, was reported to be suffering from hip-disease. On examination, the case proved to be one of Pott's disease in the lower dorsal region, with psoas abscess. Everyone will endorse Mr. Hilton's observation that in cervical disease pain is often limited to one side of the occiput, or to one shoulder or arm, for in this region disease, in some instances, involves the articular processes rather than the bodies of the vertebræ.

The true meaning of pain referred to distant parts in these cases is apt to escape notice. A child of 5 had been treated for several weeks with alteratives and regulated diet for pain at the epigastrium. It was, however, ascertained that the digestive organs were healthy, that he was free from pain when he was lying down, and worse after exercise, and that he held his dorsal spine stiff, and was unable to stoop. On examination of the spine, angular curvature was found in the upper dorsal region. A man of 30 came to the hospital, having suffered with such severe pain in his left

hypochondrium that it "doubled him up." As he had not been relieved by aperients, fomentations, etc., it was thought he had malignant disease of the descending colon. He had, however, Pott's disease. Disease in the lumbar spine may be mistaken for sciatica or chronic rheumatism. A woman, aged 40, had been taking medicine and using liniments during eighteen months for gradually increasing "rheumatism" of the lower extremities. This patient, when she was examined at the hospital, was found to have advanced Pott's disease, attended with angular curvature and a lumbar abscess. Such oversights are becoming more and more rare in the present day, and it may be thought superfluous to make any reference to them. The writer alludes to them in the consciousness that the last attitude of the mind to become habitual is that of thoroughness in the diagnosis of cases when the symptoms observed *prima facie* suggest some trivial affection; and because, not infrequently, trivial symptoms are due to very grave forms of disease.

The feeling of constriction—as if a cord were drawn tightly around the abdomen—which is mentioned as a common symptom of Pott's disease, is occasionally met with, but in my experience it is but seldom well marked.

When the patient, if he is old enough to do so in a trustworthy manner, has given his own account of the degree and situation of his pain, there are certain questions to put to him, the answers to which may be depended upon to help very materially in the diagnosis of the case. These are: whether it hurts him to laugh, cough, or sneeze, to travel in an omnibus or train, to make a false step in walking, to lift a heavy object. These questions apply chiefly to cases in which the dorsal or lumbar spine is under suspicion. They are of less value in respect to the cervical region. In many cases of disease in the middle or lower part of the column

they elicit very characteristic answers. The patient, at the mere thought of coughing or sneezing, looks uneasy and apprehensive, and says that these acts hurt him dreadfully, or that he is afraid to perform them. As to a false step, he says, almost with a shudder at the mere thought of it, that it jars him terribly. The uneasiness or pain caused by driving or railway travelling is often very suggestive. Some patients who can walk slowly and cautiously without pain cannot bear the jar of a vehicle or a railway carriage.

It must be remembered that a negative answer to some or even all of these test questions must not be regarded as any proof whatever that spinal disease is not present.

2. *Loss of natural mobility.*—The next group of symptoms by which early Pott's disease may be recognised refers to the degree in which the column retains or has lost its natural mobility. These symptoms must be tested by various exercises which the patient is made to perform. It must be ascertained whether, while standing with his heels together and keeping his knees straight, he can stoop without restraint, so as to bring the tips of his fingers towards his toes; whether he can stoop freely and raise himself freely in the act of picking up some small object from the floor; whether he can raise himself easily from the recumbent to the sitting or upright posture; and whether, when he lies on his back, he can turn readily on either side. In these various exercises it must be carefully observed whether all parts of the spine contribute their proper share of movement, or whether any part is kept rigid while movement is free above and below it. If the cervical region is suspected, in addition to the usual flexion and extension movements, the patient's power of nodding and rotating the head must be observed, in order to test the joints between the occiput and the atlas,

and between the atlas and axis. The patient's manner of walking must also be scrutinised for the same purpose of seeing whether the spine is movable in all its parts, or whether any region is stiff. Especial attention should be paid to the manner in which he turns round. A defect either in movement or in the posture in which the spine is held is sometimes perceptible in the act of turning round, which is not apparent while the patient is moving straight forward. Sometimes, again, it will be found that the column is defective in steadiness—that it seems insecure and difficult to balance. The test of picking up some small object, such as a pencil or a coin, is a very telling one, especially in children. If the spine is sound, the patient will stoop and raise himself without a pause, without hesitation, and without restraint. But if mischief is present, his proceedings are often very characteristic, and, in almost every case, peculiar enough to afford some information. A glance will show that he is calculating how to manage so that he can keep his spine still. If his disease is acute, he will probably give up the attempt, and say that he cannot stoop. If he perseveres, he will often place himself so that the object is at his side; he will then cautiously bring his hand towards the ground, not by bending or inclining his spine, but by flexing his knees while his spine is kept rigid and nearly perpendicular. Having at length succeeded in grasping the object, he will pause so as to be sure of his balance, and will then raise himself by straightening his knees, while, as before, he keeps his spine rigid and upright. In children, the spine may be further tested by watching how the patient rises from the recumbent position. It may often be observed that he moves himself slowly round till he is on his hands and knees, and then carefully gets up. Another plan is to see how the patient can go up and down stairs. If there is disease, the spine is held stiff,

movement is restrained and cautious, and the patient, especially in coming down, will use the banisters for support.

This description is intended to be general, and, as far as may be, typical. In practice, numerous differences will be met with, but in almost every instance some of the defects of movement which have been alluded to will be apparent.

3. *Collateral transmission of weight.*—Especially in children, in whom the diagnosis must often be made not by observing two or three conclusive signs, but by fitting together several fragments of objective evidence derived from different sources, the suspicion that Pott's disease is present is strongly confirmed by the observation that the patient has some device for relieving the spine of part of the work of supporting the weight of the head and trunk. Thus, in disease of the cervical spine, he may be seen to support his chin on his hand, or to support his head with his hands, especially in the effort of rising from the recumbent posture. Some children with cervical disease will sit for hours with their elbows on a table, and with the hands supporting the head. Others, who have disease in the dorsal or lumbar region, have the habit of making their way to a chair, on which they place the palms of their hands, and over which, with their arms straight, they lean—so as to give themselves “high shoulders,” and so that the weight is taken off the spine and transmitted through the arms. Another posture very suggestive of Pott's disease is that in which the patient, having slightly bent one thigh so that the limb rests on the toes, places his hand on the middle of his thigh, and then leans over to that side—so as to convey the weight from the shoulder through the arm to the thigh. These schemes for the “collateral transmission of weight” are always worthy of very careful attention.

4. *Examination of the spinal column itself.*—This should be made while the patient stands on a level surface, with his back to a good light. The first point—reserving the cervical spine for separate notice—is



Fig. 94.—Tuberculous caries without angular deformity. There is extensive destruction of the bodies of the eleventh and twelfth dorsal vertebræ, and the intervertebral disc is almost entirely destroyed. There is a small caseous deposit in the body of the tenth dorsal vertebra.

(From a specimen, No. 1,103B, in St. Bartholomew's Hosp. Mus.)

the presence or absence of deviation of any one or more of the spinous processes. In many instances it will be easy to be certain that each process occupies its strictly normal position, and that the outline of the column is intact. This is well. But such evidence is completely negative; it has no value whatever as against the existence of Pott's disease. Fig. 94 illustrates tuberculous caries without angular deformity in the lower dorsal region. It simply shows that as yet no caving-in has taken place. If, on the other hand, a posterior curvature, either sharply angular or somewhat rounded, is present, it

is a proof that the shape of the column has undergone material change. In the great majority of instances such a deformity will in itself be enough to establish the diagnosis of Pott's disease. Yet this cannot be held without qualification, for such deformity does not neces-

sarily depend on tuberculous disease. There are certainly three other causes of angular curvature—fracture dislocation, malignant disease, and hydatid disease.* Probably there is a fourth—infantile scurvy. In any case in which the deformity had resulted from fracture, the history would be known. As to malignant disease of the column (p. 603), it must always be borne in mind that its symptoms present a most deceptive resemblance to those of Pott's disease. The differential diagnosis between the two conditions is discussed at p. 604. As to the production of angular curvature by infantile scurvy, a child, aged nine months, was under observation who was suffering in a very severe degree from this affection. Large hæmorrhages had occurred beneath the periosteum of the femur and tibia, and a considerable angular deformity of the dorsal spine had developed in the course, apparently, of about a fortnight. No post-mortem examination was obtained, but it seems probable that the curvature followed hæmorrhage into, and breaking down of the body of, one of the vertebræ by a process similar to that which, after hæmorrhage into the growing tissue of the diaphysis of a long bone immediately beneath the epiphyscal plate, may lead to detachment of the epiphysis.

But between cases in which deformity is on the one hand obviously absent, or on the other obviously present, there are some in which the appearances observed are open to an embarrassing degree of doubt. In many individuals who are perfectly sound the spinous processes are markedly irregular in length. One or two of the series are either longer or shorter than those to which they are immediately adjacent, so that either they are themselves too prominent, or, being too short, throw others into a too salient position. When this false outline of the spinous processes is met with in a patient

* Targett, *Guy's Hosp. Repts.*, 1893, l. 309.

who is either hysterical, or whose back is painful from weakness or fatigue, only very thorough and repeated examination, and careful balancing of all the points in the case, can obviate a mistake. Instead, however, of attending entirely to some particular spinous process which looks suspicious, the outline of the parts of the column immediately above and immediately below must also be observed. Often it is clear that a spinous process is merely either too long or too short, and that those next it are in a natural line with one another. But, on the other hand, it may be seen, especially in the upper dorsal region, that one particular spinous process seems over-salient, and that immediately above this the spine has lost its normal curve, and has become for some distance absolutely straight. This straightening of the spine, directly above a distinctly prominent spinous process, however slight the projection may be, is a piece of evidence of very great force in any doubtful case.

The presence of lateral curvature in the early period of Pott's disease in the lumbar or dorsal region is by no means rare, and may be very deceptive. It is found in cases in which all the direct symptoms of the disease are absent, with the exception of slight stiffness of the spine, and a minor degree of pain, such as is frequently felt in cases of mere lateral curvature. If, however, the fact that there is some rigidity of the spine secures attention, and so excites suspicion, further observation of the case will lead to a correct conclusion, especially when it is found that the lateral curvature sometimes entirely disappears after horizontal rest. A close observer may also find, where the upper meets the lower segment of the lateral curvature, some marked rigidity of the erector spinæ on one or both sides of the line of the spinous processes, so that the muscle stands out and produces a perceptible fullness. A posture

which is very suggestive of Pott's disease is that in which the column leans over either laterally, or laterally and at the same time backwards, so that the patient seems to have a difficulty in keeping his balance. This leaning-tower position of the trunk is usually combined with an unsteady or insecure gait, and with rigidity of the spine, and also with marked inability of the patient to stoop, or to lift even a light weight. It always indicates grave disease, and shows that no time must be lost in the adoption of adequate treatment. It probably depends on the fact that the disease has extended on one side to, or has primarily involved, the neural arch of the vertebra, so that the articular processes are concerned. When this is the case, the spine leans over to the opposite side in order that pressure may be removed from the affected structures; or it may be that the disease, instead of being situated mainly in the bodies, has its chief seat in the lateral parts of the column, so that the upper segment leans to the side rather than in a forward direction.

There is another condition of the column which requires notice. In cases of slowly advancing Pott's disease in the lumbar or the lower dorsal region, the spine at this part becomes rigid, and then, between two vertebræ a little higher up, a degree of compensatory movement is gradually developed, which, *prima facie*, would seem almost impossible. It is so free that, as the patient walks, the trunk above the level of rigidity oscillates with an obvious jerk from side to side.

I must now venture on some repetition of what has been said as to the absence of deformity of the spine in cases in which Pott's disease is not only present, but has become considerably advanced. In the dorsal region, deformity, either angular or of a more or less rounded outline (when the bodies of two, three, or more vertebræ are undergoing absorption), generally makes

its appearance early, and this is especially the case in children. But, in the lumbar region, posterior curvature, whether angular or rounded, occurs much more slowly, for, in the first place, the bodies of the lumbar vertebræ are larger and firmer in structure than are the dorsal; and, secondly, the dorsal spine has already a posterior convexity which, in the presence of disease, readily becomes an angular curvature, whereas the lumbar spine presents a posterior concavity. So that in the lumbar region, although, as the result of loss of substance of the bodies of the vertebræ, the column is yielding and altering in shape, this alteration will not at first show itself as a posterior projection: it will consist merely in the obliteration of the normal concavity. In other words, the first effect will be that the spine becomes straight (*see* Fig. 94). Angular deformity will be developed only when a still further destruction of bone has taken place. In examining the lumbar spine, therefore, it is not enough to ascertain whether or not angular curvature is present. It is necessary also to observe whether the normal posterior concavity is preserved, or whether this concavity has been obliterated so that the outline of the spine is straight. If the lumbar spine is found to be straight, particularly if there is any thickening and filling up of the vertebral grooves on either side of the spinous processes, a suspicion must be entertained that disease is present.

In the cervical region, where the bodies of the vertebræ are small, Pott's disease quickly produces deformity, but deformity does not present itself as angular curvature: for, in the first place, here, as in the lumbar region, the column is concave posteriorly; and, secondly, the spinous processes are, with the exception of that of the axis, comparatively small. Moreover, in the cervical much more often than in the dorsal

and lumbar regions, disease is situated in the articular processes and the adjacent parts of the neural arch as well as in the bodies (p. 550). The result is that, under the weight of the head, the column yields not only in front, but laterally, and some form of wry-neck is produced.

Instead, therefore, of looking for angular curvature when disease is suspected in the cervical region, one must notice whether there is any appearance of wry-neck, whether the neck seems to be abnormally short (as if the patient were high-shouldered), whether the spinous processes can be felt to be thrown out of line and displaced to one or other side, and whether there is any widening of the column behind, by thickening or swelling at the sides of the spinous processes.

I should like here to remark that certain tests which are sometimes employed appear to be of second- or third-rate value in comparison with those which have just been described. Certainly, if in any particular case diagnosis is still doubtful after the tests already mentioned have been applied, those now to be considered will be very apt to mislead. There is, first, the searching for local hyperæsthesia by applying a hot sponge from above downwards along the line of the spinous processes. In many cases no local hyperæsthesia of the skin is present in Pott's disease. It is much more frequent in neurotic patients whose spines are weak and painful; while children will wince when a hot sponge is applied, although their spines are perfectly normal. The same objection must be raised to the method of tapping with the knuckles, or dealing a slight but sudden blow with the closed hand on the spinous processes of the suspected vertebræ. This proceeding is very likely to make a child or a neurotic adult shrink, although the spine is free from disease; while, on the other hand, cases are quite common in

which, although angular curvature is present, so that Pott's disease has obviously reached an advanced stage, this test does not produce any pain, or even the slightest discomfort. Some surgeons deal the blow on the top of the head, or press the shoulders down with a slight jerk. Sometimes patients complain of sharp pain when these proceedings are employed, but the result is often negative, while such tests are not always free from risk (e.g. even a light blow on the head) if disease involves the upper cervical vertebræ.

Symptoms of quiet Pott's disease.—The symptoms of Pott's disease vary considerably in different instances as to the degree in which they are developed (p. 560 *et seq.*). In some cases pain, stiffness and impaired function are so marked that they at once challenge attention, while in others all symptoms are so nearly absent that the main evidence of advancing disease is a slowly increasing angular deformity; but cases are occasionally met with which go still farther in this direction, and in which the usual symptoms are entirely absent. Thus I have met with a patient, aged 19, who had a perfectly distinct angular curvature of the lower dorsal spine, of which he could give no account. His back was strong, and he was leading an active life; nor could he remember any period at which his spine had given him any inconvenience. In another case, a man, aged 45, while rubbing himself after a bath in a room in which there was a large looking-glass, noticed a swelling in his back, of which, till that moment, he had been totally unconscious. Feeling alarmed, he consulted a surgeon about it, and I saw him three weeks later. The swelling was produced by a well-marked angular curvature, due to the projection of the tenth dorsal spine. So far as could be said without dissecting the parts, the case was one of angular curvature following Pott's disease. The

patient, however, was quite clear upon the point that his back had never, as far as he could remember, given him any inconvenience, nor had he ever had an accident involving his spine. Even when he was told how difficult it was to believe the condition could have been developed without some attendant symptoms, he still maintained that he could throw no light upon the subject. Such cases are very remarkable. To some, they may appear inconceivable; but I may confirm my own observations by mentioning that both the late Sir James Paget and the late Sir Thomas Smith informed me that they had met with exactly similar instances.

How can such cases be explained? One view might be that the patients were careless and unobservant; for it is not rare to see a person who has overlooked some affection from which he is suffering, but which, it would be thought, must have attracted his attention. Both the patients I have mentioned were intelligent men: one was reading for the law, the other was a retired officer of the British army. Some light may, I think, be thrown on the subject by a reference to what is not rarely seen in tuberculous disease of the joints, namely, that the inflammation which the tuberculous process provokes may be plastic in its character, and may end, apparently in a few months, in firm fibrous or complete bony ankylosis. In these cases a joint (it has been either the elbow or the shoulder) is found to be firmly ankylosed, but how or when the ankylosis occurred the child's parents have been quite unable to explain. It would seem as if the tissues, although unable to prevent the establishment of the tuberculous process, yet maintain a vigorous struggle against its advance, and, gaining the day, speedily undergo sound repair, at the cost, however, of ankylosis. In this way, perhaps, a case which occurred a few years ago may

be explained. A boy, aged 9, had an obvious and advancing angular curvature of the dorsal spine, for which complete rest and a plaster-of-Paris jacket were employed. When the treatment had been followed for six months, the patient was taken to a bone-setter, who said that one of the buttons of his back was out. The button was accordingly put in by manipulation, and the bone-setter then ordered the boy to go about as usual. This he did, and no further development of spinal symptoms has since occurred. Now, the fact is well known that when angular curvature has become marked, and is still increasing, sound repair does not generally take place in so short a time as six months; but the form of plastic inflammation leading to rapid ankylosis, which I am alluding to, may run its course well within this period.

It may be useful to draw attention in a pointed way to these cases of quiet disease of the joints and spinal column. Clinically, they are of much interest, because they are opposed to common experience in two respects: first, they run their course much more rapidly than average cases do; and, second, they always end, so far as I know, in firm ankylosis, which the surgeon can do nothing to avert. Ankylosis is a result which, unless an authentic statement can be made to the contrary, parents will attribute to the use of splints; but, in the cases I am referring to, splints are certainly not responsible for the result. It would have occurred just the same (but probably after, for the want of them, serious deformity had taken place) if they had never been employed. This is shown by the examples of quiet disease which have been mentioned; while, on the other hand, it is frequently seen that tuberculous joints, which have been kept uninterruptedly in splints for eighteen months or two years, recover, with absolutely free movement. In short, ankylosis is determined by the

plastic character of the inflammatory process, and not by the fact that the joint is kept at rest. In practice these cases—in the instance of the joints—can generally be recognised by the circumstance that whereas usually, when the limb is kept at rest, the movements of the joint steadily become more free, in these plastic cases the joint becomes more and more fixed, so that any movement that was at first present is soon entirely lost. In Pott's disease these cases disclose themselves by the early subsidence of pain and sensitiveness, so that the patient can turn in bed and execute other movements with freedom; and by the development of solidification and stiffness of the spine, so that the column appears as firm as a united fracture.

The wide variations in the symptoms to which allusion has been made in the foregoing paragraphs indicate that, in the management of Pott's disease, great care and close observation are required. Without them, in some instances, treatment will be continued long after all disease is at an end; while in others, misled by the absence of characteristic symptoms, the surgeon will be induced to interrupt treatment, although serious disease is still in progress.

Complications.—1. *Abscess.* As in tuberculous disease elsewhere, the formation of a chronic abscess in caries of the spine frequently occurs. It is more liable to occur in cases of superficial caries, and consequently may be met with in cases where there is little or no deformity. The abscess usually forms in front of or at the sides of the bodies, and tracks in the plane of least resistance, pointing in varying situations according to the site of the disease.

In the upper part of the cervical region a retro-pharyngeal abscess usually results, or the pus may track backwards to the suboccipital region. Lower down in the cervical region, the abscess makes its way

into the posterior triangle of the neck, and more rarely passes downwards into the thorax.

In the upper dorsal region the abscess usually tracks backwards between the transverse processes and points posteriorly, or it may track along the ribs behind the pleura and suggest by its presence caries of a rib, which, indeed, may be present as a secondary condition. In the lower dorsal region pus may pass down beneath the crura of the diaphragm into the substance of the psoas.

In the lumbar region the pus, which is prevented from passing forwards by the strong anterior common ligament, passes laterally into the substance of the psoas (Fig. 95), or more rarely backwards into the loin. A psoas abscess may extend downwards into the thigh beneath Poupart's ligament for some distance, so that its primary connection with the spine may be lost sight of; or matter may pass outwards into the iliac fossa and be mistaken for an appendix abscess, or more rarely may find an exit through the great sacro-sciatic notch into the gluteal region. A psoas abscess points above Poupart's ligament, or, lower down, in Scarpa's triangle, either externally or, later, internally to the femoral vessels.

Treatment of abscesses.—When suppuration occurs, the abscess should at once be evacuated under the strictest aseptic precautions. In the neck, great care is necessary to avoid injury to important structures; deep anæsthesia should be avoided, and Hilton's method should be adopted. A post-pharyngeal abscess will often point and should be opened behind the sternomastoid. The cavity should be gently swabbed out with 1—5,000 perchloride of mercury, the wound closed, and sufficient dressing applied to prevent movement of the head and neck. Should reaccumulation occur, the cavity can again be emptied. The risk of a mixed

infection occurring if drainage is adopted is so great that it is preferable to close the wound in the hope that no further suppuration will occur.

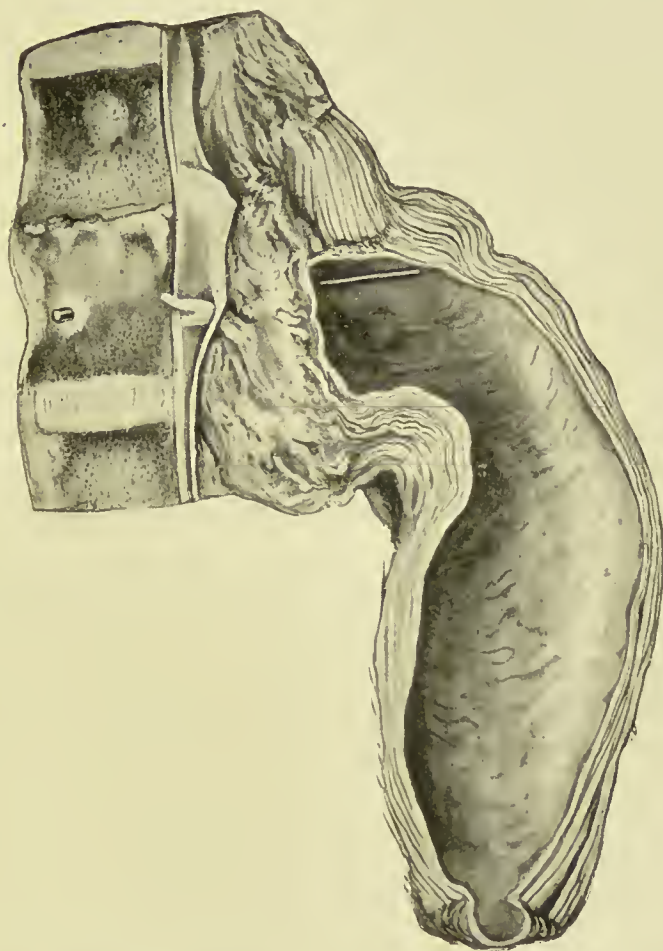


Fig. 95.—Psoas abscess due to tuberculous disease of the lumbar vertebræ. A glass rod has been passed from a caseous deposit in a vertebral body into the abscess-cavity. The intervertebral disc above has been completely destroyed.

(From a specimen, No. 1,171b, in St. Bartholomew's Hosp. Mus.)

The same principle applies to the treatment of *psoas abscess*. In recent years there has been a great advance in the treatment of this condition. Formerly, when drainage was the rule, a sinus often remained

for months, and not infrequently, as the result of secondary infection and prolonged suppuration, there was a fatal termination.

All cases of caries in the lumbar or lower dorsal region should be carefully watched for the formation of a psoas abscess, and the abscess dealt with before it points. A psoas abscess seldom gives rise to any pain or inconvenience in the early stage, and may not be noticed unless examined for. Occasionally the mother may notice that the child walks a little lame, or lies with the thigh slightly flexed. If the abscess is pointing above Poupart's ligament, it is incised in this situation, the pus evacuated, and the cavity explored with the finger. Then with gauze swabs on forceps the interior of the cavity is most carefully and gently scraped to remove the membranous wall, the cavity being flushed out at the same time with saline solution. This process should be persevered with until all membrane has been removed and the flushings are clear. It should be remembered in this connection that the cavity frequently extends under Poupart's ligament into the thigh. A Volkmann's spoon or flushing curette should be avoided. The psoas is often so thinned out as to be a mere shell for the abscess. Consequently, penetration into the peritoneal cavity may easily occur from incautious use of the curette, or troublesome hæmorrhage (from the lumbar arteries which run behind the psoas) might follow too vigorous scraping. Small sequestra are occasionally met with in the abscess-cavity and washed out. The seat of the disease can sometimes be felt with the finger, but more often the communication with the diseased vertebræ is by a narrow neck. No attempt should be made to scrape away carious bone. Such a proceeding may produce or increase deformity by breaking down what little supporting structure remains to the body of a carious vertebra, or may result in open-

ing up the spinal canal to infection. When an abscess has formed, it is usually an indication that active tuberculous inflammation is at an end, and that waste products are being cast out. It is therefore important not to stir up inflammation afresh, but merely to evacuate the pus, and to secure, if possible, immediate closure of the cavity.

After thorough flushing out of the cavity the wound should be closed and firm pressure applied over the psoas to keep the walls in contact, and to prevent any accumulation of blood from oozing. Many surgeons inject iodoform emulsion before closing the wound. Against this practice it may be urged that the iodoform frequently becomes caked, and then acts as a sequestrum, and that in some cases iodoform-poisoning has resulted. The cavity should not be irrigated with strong antiseptics, because of the wide area for absorption. If iodoform emulsion is used, it should be squeezed out again before closing the wound. Should reaccumulation of pus occur, then a stitch can be removed and a direct or passed into the cavity. If there is any contraction of the psoas muscle with flexion of the thigh, weight-extension should be applied. This serves not only to overcome contraction, but to keep the psoas muscle on the stretch, and so, aided by pressure applied over the iliac fossa, to keep the walls of the cavity in contact. At the same time it is advisable to apply a long Liston splint to the opposite side, to keep the child still in bed. Careful, yet gentle, cleansing of the cavity, firm pressure, and absolute rest are the three essentials of success. If bleeding occurs during the treatment of the abscess-cavity, then drainage should be adopted for twenty-four hours or so, to prevent an accumulation of blood in the cavity. If the hæmorrhage is severe, the cavity should be packed with strips of gauze for twenty-four hours. In this way.

an immediate cure, as regards the abscess, is often possible. In quite small abscesses, or for the subsequent purpose of drainage, a lumbar incision, as originally suggested by Sir F. Treves in 1884,* may be used.

Many surgeons rely on simple aspiration for a psoas abscess, repeating the aspiration if necessary. By this method the risk of sinus-formation is diminished, more especially if the needle is introduced into healthy tissue as far as possible from the site of the abscess, so that a valvular track results when the needle is withdrawn. This is the practice which has been adopted with considerable success at the Cripples' Home at Alton. If the pus is caseous and too thick to flow readily through the aspirating needle, it may be dissolved by first injecting a modifying liquid, such as a glycerine emulsion of iodoform or a solution containing thymol, camphor, naphthol, and ether. At Alton, Gauvain has found 1 c.c. of a solution containing 1 part of camphor, 2 of thymol, and 3 of ether the most useful in facilitating aspiration, if injected twenty-four hours before operation. Naphthol, though a good solvent of caseous pus, is not to be recommended, as symptoms of toxæmia have occurred after its use.

When a sinus persists and prolonged suppuration follows the opening of a psoas abscess, a mixed infection is usually the cause. In such cases cultures should be grown, a vaccine made from the prevailing organisms, and the patient inoculated. It may be that suppuration is kept up by a sequestrum, and it may be possible to localise this under the X-rays. In other cases, pockets are formed which are not adequately drained. If in these cases the cavity is injected with an emulsion of carbonate of bismuth and then a radiograph is taken, the full extent of the abscess and its loculi may be observed. (Plate 11.) The bismuth will do no harm,

* *Med.-Chir. Trans.*, lxvii. 113.



PLATE 11.—TUBERCULOUS DISEASE OF THE SPINE WITH
PSOAS ABSCESS.

Bismuth has been injected into the abscess-cavity, to show the track leading
from the carious bone to the external sinus.

(Radiogram by Dr. Finzi.)

and by some is thought to promote healing. Another cause of failure, which may sometimes escape observation, is the presence of an abscess-cavity in the opposite psoas. Not infrequently there is a communication between the two, by way of the diseased vertebræ, and sometimes fluctuation can be obtained from one to the other. In a case recently seen, a chronic sinus had resulted from the opening of a psoas abscess; this rapidly healed as soon as an abscess was discovered and opened on the opposite side.

It is well to bear in mind that a chronic psoas abscess may in rare instances result from caries of the sacrum and from disease of the sacro-iliac joint.

2. *Pressure and paraplegia.*—Even if its effects were entirely limited to injury done to the skeleton, Pott's disease would be of very grave import. But its gravity is much increased by the circumstance that, owing to its proximity, the spinal cord itself may become involved. Fortunately, in a large number of instances, the cord and its membranes escape, for the disease concerns only the bodies of the vertebræ, and the products of inflammation, whether they consist of granulation-tissue or of pus, collect in front or at the sides of the column, and do not pass backwards to invade the neural canal. In other instances, however, this extension backwards does occur (Fig. 93); while in others, again, the tuberculous process has its main seat, not in the bodies, but in the articular processes and laminæ.

When this is the case, inflammatory products accumulate between the bony walls of the canal and the external surface of the meninges, or in the meninges themselves, with the effect that the resulting pressure on the cord may lead to paraplegia. In his work on "Diseases of the Nervous System,"* in an admirable chapter on

* Vol. i., p. 246.

compression of the spinal cord, Sir William Gowers states very clearly that pressure produces myelitis. He writes :—

“The cord (on post-mortem examination) usually presents evidence of the compression it has endured in considerable narrowing at the spot compressed, where it may be indented, flattened, or cylindrical. . . . At the compressed part the cord is usually grey in tint: its consistence is lessened in early cases, and is increased in those of long duration. The change in colour and consistence is due to inflammation of the substance of the cord, which always results from pressure, and may often be traced for some distance above and below the compressed part. When there is much compression there is always much inflammation, but considerable myelitis may occur when the amount of compression is slight. The inflammation may be chronic and slow, developing in proportion to the pressure, or it may be subacute or acute, even when the pressure is gradual. The signs of inflammation are very distinct on microscopical examination, and resemble those of other forms of myelitis.”

In his able lectures on the surgery of the spinal cord and its membranes, Mr. Thorburn remarks :—

“The exact *modus operandi* of this pressure is still open to question. The school of Charcot attributes the mischief to myelitis spreading from the point of pressure across the cord: but most recent observers do not accept this view, and it is certain that pressure alone (without myelitis) may cause paraplegia. The simplest explanation of such a condition would be that the pressure causes anæmia and subsequent degeneration of the cord, and in some cases we find the latter thinned and firm in texture, as if this were the true explanation. . . . Others find that œdema and swelling of the cord are more common than constriction, and this condition is generally attributed to an extramedullary compression of veins and lymphatics causing congestion and lymph-stasis.”

Some further causes of paraplegia are met with, though they are certainly rare. It may be produced by the direct pressure of the bones themselves upon the cord. It is often seen in museum specimens that when—in the development of angular curvature—

several of the vertebral bodies are destroyed, the corresponding neural arches, which are still entire as the column yields, are bowed out backwards, with the result that the canal is considerably enlarged. (Fig. 92.) But, on the other hand, it must be pointed out that, when only one body—say the fourth dorsal—is lost, the upper segment of the column leans abruptly forward,

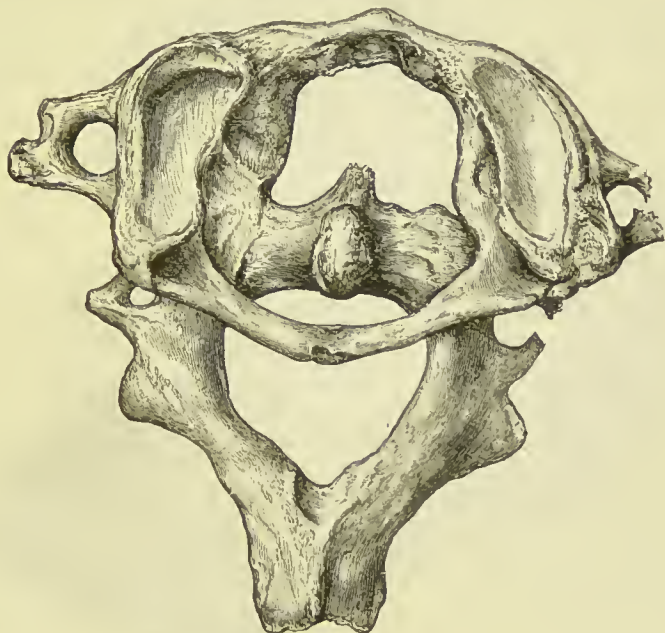


Fig. 96.—Displacement of the atlas forwards upon the axis as a result of Pott's disease. The bones are firmly ankylosed together.

(From a specimen, No. 1,094, in St. Bartholomew's Hosp. Mus.)

so that the space between the upper edge of the body of the fifth dorsal vertebra and the arch of the fourth is materially narrowed, and the cord is more or less compressed. In Fig. 96, the antero-posterior space left for the cord has been reduced to one-fifth of an inch. As the specimen is without a history, it cannot now be said whether paralysis was present; possibly the cord had been able to accommodate itself. But

with such a condition of parts in view—and many similar specimens could easily be produced—the compression of the cord by bone-displacement is beyond doubt. On the other hand, distinct narrowing of the canal may result from angular curvature without producing paraplegia. (Fig. 97.) Compression leading to paraplegia

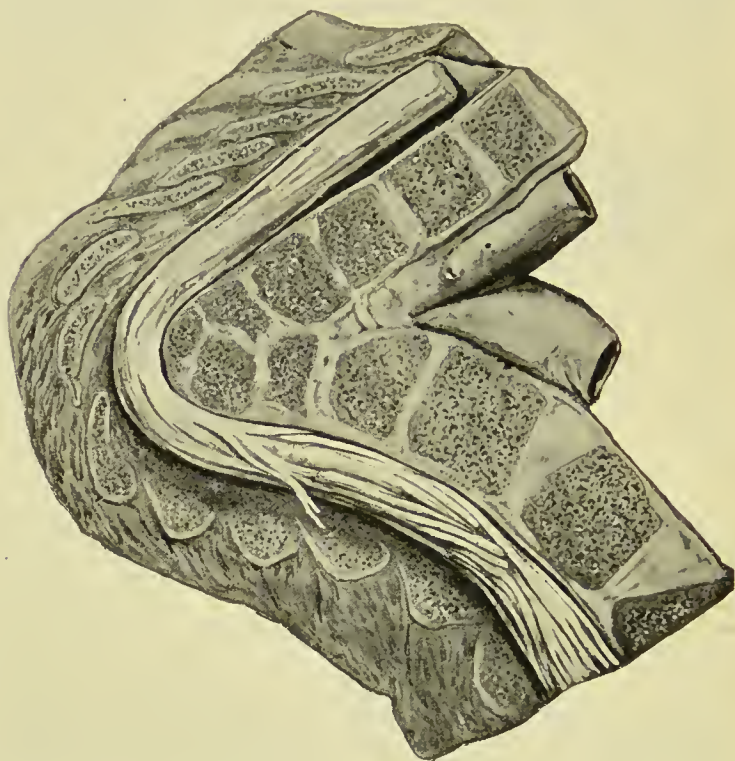


Fig. 97.—Extreme angular curvature with firm consolidation. The spinal canal is slightly narrowed and the aorta is acutely flexed. There were no symptoms of paraplegia.

(From a specimen, No. 1,102, in St. Bartholomew's Hosp. Mus.)

may, though such events are very rare, be caused by a displaced sequestrum, by fracture through a carious vertebra, followed by displacement, by hæmorrhage,* or by the sudden bursting of an abscess into the spinal canal.

* Thorburn, *Brit. Med. Journ.*, 1894, i. 1345 and 1401.

Interference with the nerve-supply to the parts below may occur as the result of disease at any level of the spinal column. This result, however, is much more frequently met with in the upper dorsal region than elsewhere. Here, as the spinal column is comparatively fixed, the neural canal is small, and there is very little space between it and the cord, so that a limited amount of granulation-tissue exercises injurious pressure. On the other hand, the canal in the cervical region is of large size, in order to permit the free movement of the column without injury to the cord, and here a considerable amount of granulation-tissue may collect without affecting the cord.

In the lower dorsal region, also, pressure-symptoms due to granulation-tissue within the canal are rare. In the lumbar region they are still more rare, for the cord has broken up into the cauda equina, and the individual nerves are firmer in structure and protected by a sheath, so that they are tolerant of compression.

The construction of the upper part of the cervical spine has much to do with the degree to which the cord may suffer in Pott's disease at this level. In the first place, the bodies of the vertebræ in this region are comparatively small and are therefore easily broken down, and, secondly, provision is made for free flexion, extension and lateral rotation of the cranium upon the apex of the column. To allow of these movements the atlas has been deprived both of its body and its spinous process, and has been reduced to a mere ring. Thus, when the vertebræ in this region are examined, it is seen that a comparatively small destruction of bone will be attended with very serious results. The normal position of the head upon the apex of the column depends upon the integrity of the articulation between the atlas and the axis, the essential parts of which are the odontoid

process and the transverse ligament. If either of these structures is involved in disease, the mechanism for the support of the head is thrown out of action. As to the odontoid process, it may be more or less removed by caries, or it may be so weakened that fracture occurs through its base at its junction with the body of the axis. As to the transverse ligament, when it has become softened or eroded it may suddenly give way. Whichever event occurs, the result to the cord will be equally disastrous. If the odontoid process gives way, and the head, with the atlas, falls forwards, the cord is drawn forwards also, and is crushed against the upper and back part of the body of the axis; while, if the transverse ligament gives way, and the odontoid process remains in place, it is upon the apex of the latter that, when the head falls forwards, the medulla oblongata is impaled. Either of these accidents is, of course, instantly fatal.

Should displacement of the atlas upon the axis occur slowly, the cord, as numerous museum specimens prove, has the power of accommodating itself to a degree of pressure that seems scarcely credible. Thus Fig. 96 shows an atlas and an axis between which firm bony ankylosis has taken place, and it is seen that the atlas has travelled forwards and downwards in relation to the axis, so that the space between its posterior arch and the apex of the odontoid (which space, of course, transmitted the upper part of the cord and the commencement of the medulla oblongata) is reduced to a mere chink. In the specimen this chink measures only one-fifth of an inch. That the patient long survived the displacement is obvious from the completeness of the ankylosis which has occurred.

Fig. 98 shows a remarkable condition of things. In consequence of yielding of the transverse ligament, in the course of Pott's disease, the head, together with

the atlas, has subsided in a direction forwards and downwards to such a degree that the spinal cord has become sharply bent over the apex of the odontoid process:

Fortunately, paraplegia is comparatively rare in Pott's disease; probably it is not met with in more than about 5 per cent. of the total number of cases. In instances that are adequately treated in their early stage it is almost unknown. The probability of its occurrence bears no close relation to the amount of deformity which the spinal column has undergone. In fact, when several vertebral bodies have been destroyed, the size of the neural canal, instead of being diminished, is often considerably enlarged. When, on the other hand, only one vertebral body is lost, the column bends at an acute angle and there is much more danger that the cord will be subject to direct pressure.

Motor paralysis is accompanied by exaggeration of both the superficial and the deep reflexes. Knee-jerk is increased, and more or less ankle-clonus is present. Sensation is usually unaltered; but there may be hyperæsthesia, or patches of anæsthesia, in the course of the nerves which leave the cord at the level of the disease. Often there is considerable wasting of the muscles in the parts below.

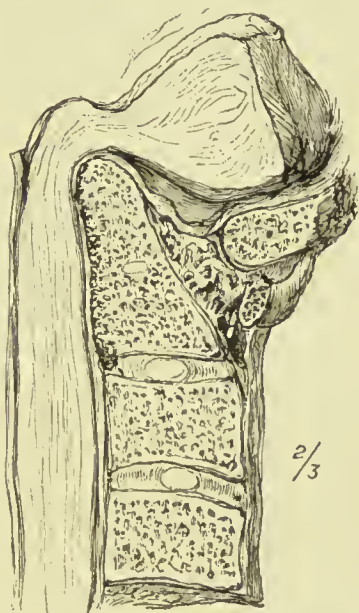


Fig. 98.—Compression of the cord by the apex of the odontoid process, following displacement of the head forwards in the course of Pott's disease.

(From a specimen, No. 1,902, in St. Bartholomew's Hosp. Mus.)

Paralysis commonly involves both lower extremities, but only one may be affected. A child of 9 was admitted into hospital on account of complete paralysis of one leg. She had been, according to the mother's report, well till four days previously, when the paralysis suddenly occurred. The cause was at first obscure, but when the spine was examined an angular curvature at the level of the sixth dorsal was found. In some instances, together with loss of movement, there is muscular rigidity (spastic paraplegia). The lower extremities are rigidly extended, and sometimes crossed over each other; and the heels are drawn up, so that the feet are in a position of talipes equinus. Occasionally there is loss of control over the bladder and rectum. As the disease, in the great majority of cases in which paraplegia occurs, is situated in the upper dorsal region, paraplegia is frequently accompanied by paralysis of the abdominal and intercostal muscles. In not a few instances this is overlooked. It may, therefore, be useful to specify the symptoms by which it may be recognised. (1) It will be noticed that during the most forcible inspiration of which the patient is capable, the lower ribs are neither raised nor abducted, so that when a tape measure is placed around the base of the thorax, it registers no increase of circumference when the attempt at a full inspiration is made. (2) During inspiration the abdomen, owing to the descent of the diaphragm and the flaccid condition of the abdominal muscles, becomes more prominent. (3) During inspiration, also, the intercostal spaces, as the intercostal muscles are flaccid, are deepened. (4) The patient cannot cough loudly: for he can neither fill his chest by a strong inspiration with his intercostals, nor forcibly empty it by a vigorous contraction of the abdominal muscles.

Paraplegia is generally developed slowly, and is indicated by gradually increasing weakness of the lower

extremities and difficulty in walking, especially in the act of going upstairs. In some instances, however, paraplegia comes on rapidly, or even suddenly.

Prognosis in paraplegia.—Although it is occasionally produced otherwise, paraplegia is very generally due to the pressure of granulation-tissue developed between the bony walls of the neural canal and the dura mater enclosing the cord. When this is the case, and the patient is kept at complete rest in the horizontal position, the paraplegia, as the granulation-tissue is absorbed, will disappear. The time required for the restoration of movement varies with the case. In some instances it is complete in the course of a few weeks; in others, it takes place very slowly. No improvement may be perceptible for six or nine months, or even for a still longer period. Yet, in the majority, recovery will at length be accomplished.

Treatment of paraplegia.—As just stated, recovery from paraplegia follows absolute rest in the recumbent position in the majority of cases.

In a limited proportion of cases, however, although horizontal rest has been fully tried, no return of movement has been obtained. This failure may depend on inflammatory softening of the cord itself, or on pressure produced by a displaced sequestrum, or some other cause (p. 581); but it is generally due to one of two conditions: either granulation-tissue has become organised into cicatricial material, by which the cord is permanently constricted; or the lumen of the canal has been seriously encroached upon by displacement of the bones themselves.

Laminectomy.—It is for those cases in which no return of power has followed prolonged rest that operative treatment by laminectomy has been introduced. This operation consists in the removal of two, three, or more spinous processes and laminae, so that the spinal

canal is opened at the point of curvature in order that the cause of the paraplegia may be ascertained, and, if possible, removed. The proceeding, in carefully selected cases, undoubtedly affords excellent results, and secures recovery which would otherwise be quite hopeless. It is necessary, however, not only to point out that in the great majority of instances of paraplegia supervening on Pott's disease laminectomy is quite uncalled for, but to emphasise the fact that the proceeding is one which, however skilfully performed, may be attended with grave results. It must be remembered that in advanced Pott's disease the bodies of the vertebræ concerned may be in great part, or completely, destroyed, so that, as far as they are concerned, the continuity of the column is more or less interrupted. Now, while the neural arches and their ligaments are entire, these structures serve to connect the segment of the spine above with the segment below the disease, and brace them strongly together. As that is the case, it is readily seen that their removal must tend to weaken the column to a perilous extent. This anticipation has been confirmed by actual cases. In some instances the result of laminectomy has been a rapid and considerable increase of deformity, while I know of one case in which, on the completion of the operation, the spine had become resolved into two distinct portions, which moved quite freely upon each other, and were separated by an interval of upwards of half an inch. The spinal cord, deprived of all bony support, passed like a bare rod across this interval. The case ended fatally.

The operation, so far as present experience may be taken as a guide, should be limited to the following cases: 1. Those in which, although absolute rest has been maintained for at least six months, no improvement can be detected. Six months is the shortest time; but if the treatment by rest can be continued,

it will be best to postpone laminectomy for a further period of three or even six months. Many cases which have been allowed the more extended period have ended, without laminectomy, in complete recovery. 2. Those in which paraplegia has followed disease situated in the neural arches instead of the bodies. In such instances, as Mr. Thorburn remarks, laminectomy "is clearly indicated, as here we can readily both treat the paraplegia and remove the whole of the tuberculous tissues." Yet it must be allowed that the differential diagnosis of this group can seldom be made with any degree of certainty. 3. Those in which complications are present which place the patient's life in urgent danger—such as difficulty in breathing, which has suddenly become more marked; or in which symptoms appear to indicate that an abscess has burst into the spinal canal. The prospect of recovery under these conditions is, however, very unfavourable, and the imminently dangerous nature of the case ought to be fully explained to the relatives of the patient.

General treatment of tuberculosis of the spine.

—As the nature and the tendencies of the morbid process are the same in the two cases, the principles upon which tuberculous disease of the spine is treated are identical with those which are followed in dealing with tuberculosis of the joints. The object in both instances is to arrest the tuberculous process by establishing conditions which place the *Bacillus tuberculosis* at a fatal disadvantage. It is now well known that this micro-organism is possessed of but a low degree of vitality, and that it readily perishes when its surroundings are unfavourable. The conditions which are most suitable to it are diminished resistance of the tissues, and an area occupied by inflammatory products—materials which furnish a highly appropriate medium for its cultivation. The main objects of treatment, therefore, are

to improve the general health, and to bring the local inflammation to an end. As to the general health, nothing here need be said. But the measures to be adopted for the arrest of local inflammatory action demand careful attention. The question is, how the structures concerned can be protected from mechanical injury, and placed at physiological rest. The disease, as a very general rule, involves the cancellous tissue of the bodies of the vertebræ, and consists, in effect, of a rarefying osteitis. The column, at the level of attack, is therefore weakened, and rendered unfit to support and transmit the superincumbent weight. The result is that it yields, and the structures involved in the disease are compressed as they lie in the angle of deformity. To appreciate fully the gravity of this state of things it must be remembered that the spinal column is a single stem which has alone and unaided to support the entire weight of the head, trunk, and upper extremities, and to act as the fulcrum of the powerful levers that are connected with it. In numerous instances in the economy, the principle of compensation comes to the assistance of organs whose functional capacities have become impaired by disease or injury. By this vicarious service damaged organs are, to a great extent, relieved from the necessity of struggling on in the discharge of functions which they are no longer qualified to perform. Thus, when the elbow-joint is diseased, its movements are to a large extent readily transferred to the shoulder and the wrist. If the shoulder-joint is diseased, its movements are performed between the scapula and the trunk, or at the elbow. If a large artery is obstructed, a collateral circulation is established. The spine, however, from the point of view of its functions, is an isolated part of the skeleton. No other part can come to its relief and work in its stead. And thus it is that, although in its normal state its endowments enable it easily to

discharge its functions, yet when one of its component segments (i.e. the body of one of the vertebræ) is diseased, it is reduced virtually to the condition of a broken pillar: Moreover, the more it leans, the greater is the force with which the affected structures are compressed. Obviously the most efficient method for putting at rest the spine so circumstanced is to place the patient in the horizontal position, and to prevent, as far as possible, any disturbance of the parts.

An admirable Cripples' Home has quite recently been established at Alton by Sir William Treloar, Bart. The treatment of spinal caries at this institution has been brought to a high pitch of excellence by the resident medical officer, Mr. H. J. Gauvain.* The methods which he adopts have been most successful, and the apparatus which he employs is most efficient. They will therefore be described here substantially in his own words, and may be taken to represent the most recent advances in the treatment of these cases.

The child is removed from the town to the country, in order to obtain an abundance of pure fresh air, and is nursed in the open air as far as is practicable.

The child's taste in regard to food is individually studied, and an ample and easily assimilated diet ordered.

The great principle on which treatment is based is absolute immobilisation of the affected part, which is fixed in such position that the progress of an existing deformity may be arrested and increase of deformity fully guarded against. In spinal cases this is secured by the use of a special spinal board (*see* Figs. 99, 100), which consists of a shallow oblong tray with a perforated base. Its size is adapted to the child intended to occupy it. The sides of the bottom of the board are raised to protect the child's feet from the weight of

* For the illustrations of the spinal board and stand I am much indebted to Mr. Gauvain's courtesy.

superincumbent clothes, and so prevent foot-drop. Means for extension of the legs are provided at this extremity of the board, and for head-extension at the other



Fig. 99.—Spinal board.

Gauvain's modification of board used at the Maritime Hospital, Burck-sur-Mer. The patient is fixed to the board by the jacket shown in the illustration, and lies on a horsehair mattress two inches in thickness. Underneath the angular curvature the cross-piece figured is placed, and hyperextension of the spine thereby secured. By fixing the child as described, head or leg extension can easily be applied without tilting the bed, and without the patient being drawn from the position in which he has been placed.

extremity. Transversely placed across the board is a piece of wood known as the "cross-piece," which is

adjustable, and this is placed immediately underneath the curvature so that the child's back may be hyperextended at this point, and deformity either prevented, arrested, or reduced.

The board is specially made of light, strong wood to facilitate its transport. In the majority of cases it is found that simple hyperextension of the child prevents the increase of deformity, but where the disease is very active it has been found sometimes desirable to apply both head and leg extensions.

The child is fixed in this board by means of a jacket made of jean and fitted *accurately* to the



Fig. 100.—Patient hyperextended on spinal board.

child's body. It is stiffened with whalebone. This prevents the formation of rucks, and assists in the preservation of a healthy condition of the skin. On the back of the jacket two stout pieces of webbing are inserted in the form of a St. Andrew's Cross, and are buckled to the sides of the board, thereby preventing the child from moving in any direction. It is essential in the use of this board to place the "cross-piece" accurately and secure the correct amount of hyperextension. A practical difficulty has been discovered in the fixation of the child, as the jacket has to be removed at frequent intervals for attention to the back. In this process there is some undue movement of the child's spine, and the nurse in charge has to be trusted with the reapplication of the jacket at the correct point on the board. To obviate this a spinal splint has been designed which is constructed of well-seasoned beech, and strengthened outside with underlying strips of hardened iron.

Measurement of the splint.—The child is placed flat on its back on a white sheet of paper "spread eagle" fashion, and the outline of the trunk traced on the paper. Care must be taken that the child does not move during this process, and the highest point of the natal cleft is marked on the pattern as indicating the lowest extremity of the spinal splint. If the splint is brought lower than this point there is danger of its becoming soiled by the child's excretions. The position of the curvature is also marked on the tracing. A piece of beech is then shaped to the form of this pattern, and cut out one inch from its border all round. The outer part is next covered with iron as mentioned, and the inner part is perforated with holes to facilitate ventilation. A handle is attached to the back of the inner part, which has received the name of "the back door." The back door is kept in place by four

clips (Fig. 101). The splint is now padded, and the highest point of the padding approximates with the point of maximum curvature of the spine. It is essential that the padding be very carefully applied, and the material which experience has proved to be of most value is animal wool. This is more springy, and does not cake, so that the surface of the padding preserves the form intended.

The jacket, made of jean, is now very carefully fitted to the child on the splint. This jacket is attached along the inner side of the outer framework by means of adjustable clips of the same nature as those used to fix ladies' dresses. By this means the jacket is easily detachable and can be replaced when soiled. Two jackets are made for each child, to allow for washing when necessary. The jacket is very carefully fitted to the shape of the child, is stiffened with whalebone, and attached across the anterior portion of the trunk by means of straps and lacing. By this means the jacket is adequately secured, and has the amount of elasticity requisite to prevent discomfort during respiration, and when there is flatulent distension of the abdomen. The outer frame is fixed to the spinal board before described by webbing, as in the case of the simple jacket. It has two straps attached to the lower border, which are provided with pads to press against the tuber ischii. These are carried round the crutch and attached to the board approximately at the level of the nipple line. They assist in the support of the child when his position is other than horizontal. When the child is in the horizontal position these become unnecessary and are removed. In cases where there is a tendency to flexion of the legs, padded back-splints are jointed on to the outer frame, and to these the legs are attached. The back-splints are so jointed that the legs may be abducted or fully extended at the hip-joint, but cannot be flexed, inverted, or everted.



Fig. 10L.—Gauvain's "back-door" splint for spinal caries.

The splint is so designed that the patient can be permanently immobilised and hyperextended to any degree required, while the back can be easily got at, and the skin thereby prevented from becoming sore. The contrivance called the back-door is easily removable from the splint, as will be seen in the illustration, and can be repadded as circumstances require. On this splint the patient can lie in comfort for an indefinite period, and increasing deformity is impossible. The patient is fixed to the splint by a jacket or by straps.

The splint may be so placed that the legs and head are dependent, and the weight of the head and legs will form a natural means of reducing the amount of curvature. Additional extension may be easily secured by a bridle to head and strapping to legs, if desired. The leg-splints may be fitted with foot-pieces if desirable, to prevent any tendency to foot-drop.

After the child has been recumbent on this splint



Fig. 102.—Gauvain's stand for spinal caries and other conditions.

The stand is so designed that it is easily portable. The patient is fixed absolutely in any position required, and can be placed in a horizontal or a vertical plane with the greatest ease. An adjustable book-rest is supplied, by means of which the patient can read and have his meals with comfort. A modification of this contrivance is in use, in which the patient can be placed in any position in any plane—face downwards if necessary—and is of particular value in the drainage of abscesses.

(Manufactured by Messrs. Maw, Son & Sons, Aldersgate Street, E.C.)

for some time, and when all signs of acute disease have subsided, there is no reason why the child should not be tilted at such an angle that he may be taught, and that he may be able to feed himself with comfort. For this purpose a special spinal stand has been devised (Figs.

102, 103), from which it will be seen that the child can be placed out of doors, can learn his lessons and feed himself. He may be supported either by the erutch straps described, or else by the adjustable seat which



Fig. 103.—Gauvain's stand, as used for reading and feeding.

is fitted to the board and can be raised or lowered at will. It will be observed that in any position the child still maintains the back arched in that position which may be found most suitable in any individual case. The back of the child may be attended to, and all danger of pressure-sores avoided, without disturbing the spine; all that is necessary is to roll the child gently on to its side and remove the back door. This should be carried out as a routine every four hours.

When the time comes for ambulatory treatment the child is put up in a specially moulded plaster jacket. This is applied during carefully arranged suspension in cases of disease in the dorsal or cervical region. In cases of lumbar eurvature it may be applied with the child in the horizontal position. It is found that if horizontal applieation be adopted when the disease is in any other than the lumbar region, increase of the curvature may oecur later. The jackets, which are moulded to the pelvis with extreme care, are more effieient and more comfortable than any other form of spinal support.

To these details it may be added that the spinal splint can be used as an ambulatory support as well, but a special mould is then arranged to enable more adequate support to be given by the fixed pelvis. A speeial spinal splint somewhat on these principles has been designed for use with children suffering from cervical earies.

The treatment just described is at present beyond the reach of the majority of the children of the poor, except the few who can be kept in institutions for chronic eases. But, in these, and in those whose parents are in good circumstances, the prognosis of Pott's disease, when treatment is begun while the mischief is still limited, is very much more favourable than many would readily believe. If curvature is not already developed, complete recovery will take place in from 80 to 90 per cent. of the cases. Curvature already present, in the great majority of instances, will not further increase. In some instances a curvature which, without being extensive, was yet perfectly well marked, has disappeared. After recovery, the spine, at the level of the disease, usually remains fixed, because bony ankylosis has occurred.

The period during which horizontal rest should be continued varies. In incipient cases it must be six

months (very rarely sufficient), nine months, a year, or even longer. The surgeon must take into account the stage the disease had reached before treatment was commenced, and the degree of its activity; and he must be further guided by the time that has elapsed since the curvature showed any tendency to increase, and since the patient complained of pain, or seemed sensitive on slight movement, or on coughing, sneezing, or forced inspiration. It can only be said, in general terms, that when Pott's disease has once been established, recovery is very seldom complete in less than twelve months. In more advanced cases the time must be commensurately extended. A large proportion of cases which have been in progress for from three to six months will recover in the course of the second year of horizontal rest. In some instances of advanced disease, recovery without subsequent relapse has occurred after rest had been maintained for four years; while in the case of a woman of 44, in whom disease had existed for two years, recovery, apparently with bony ankylosis, took place only at the end of seven years. This patient, however, is now sound and active. These periods may doubtless appear long, but the necessary time is well spent. The same result cannot be obtained by any other known method of treatment in so short a time, with the same degree of certainty, and with such a limited amount of deformity and infrequency of suppuration.

CHAPTER II

MALIGNANT DISEASE OF THE SPINE

THE spinal column is liable to be invaded by two forms of new growth of a malignant character, sarcoma and carcinoma.

SARCOMA

Primary sarcoma may be either periosteal or endosteal. The endosteal variety begins in the cancellous tissue of the body of one of the vertebræ. The periosteal may involve either the body or some part of the neural arch. The endosteal, from the specimens I have been able to examine, is more common than the periosteal form. Microscopically, the growth is found to consist of either round, or spindle, or mixed cells. Myeloid sarcoma of the vertebræ appears to be very rare, even if it ever occurs. When sarcoma becomes disseminated, secondary deposits may take place in the spine. Thus, No. 1,130 in the museum of St. Bartholomew's Hospital is a specimen of sarcoma involving the right side of the sixth cervical vertebra of a woman who had primary sarcoma of the uterus: other deposits were found in the lungs and pericardium; and No. 483 shows secondary deposits in the spine in a case of melanotic sarcoma, of which the primary seat was a cutaneous mole.

In whatever manner the disease originates, it usually undergoes rapid development. As the growth increases in size it may protrude in front or at the sides of the bodies of the vertebræ; or it may extend into the neural canal and speedily involve the cord. The affected

vertebræ become widely infiltrated and broken down, and the destruction of bone is usually great.

The clinical history of sarcoma of the spine is extremely grave. The disease uninterruptedly and, as a rule, quickly advances, and few of those who are attacked by it survive more than six months.

Symptoms.—These are, in general terms, identical with those of Pott's disease; yet, on close examination, certain differences are to be observed which should before any long period has elapsed raise a strong suspicion as to the real nature of the case. (1) Pain is generally much more severe, and from the first is altogether a much more prominent symptom, in sarcoma than it is in even the most acute cases of Pott's disease. In some cases it soon amounts to agony, especially on any attempt at movement, nor is it materially relieved by rest. (2) Paraplegia, or paralysis of a limb or of a single group of muscles, is commonly present early; and, instead of passing off when the spine is placed at rest, as paralysis may do when produced by Pott's disease, it steadily, or more often quickly, becomes more marked and extensive. (3) Incontinence of urine and fæces is soon developed, and pressure-sores are very apt to form. These features of severe pain, persisting in spite of rest, increasing paralysis, incontinence of urine and fæces, and pressure-sores, all show that the spinal cord itself has become involved, either by extension of the disease to its substance, or by pressure of the new growth upon its surface. (Plate 12.) Such symptoms are not usually met with in Pott's disease, and their occurrence should, therefore, always raise a suspicion, in any case in which they are observed, that a new growth may be present. (4) The disease usually advances rapidly, so that deformity (often distinct angular curvature) is developed early, perhaps in the course of a few weeks. It should, however, be re-

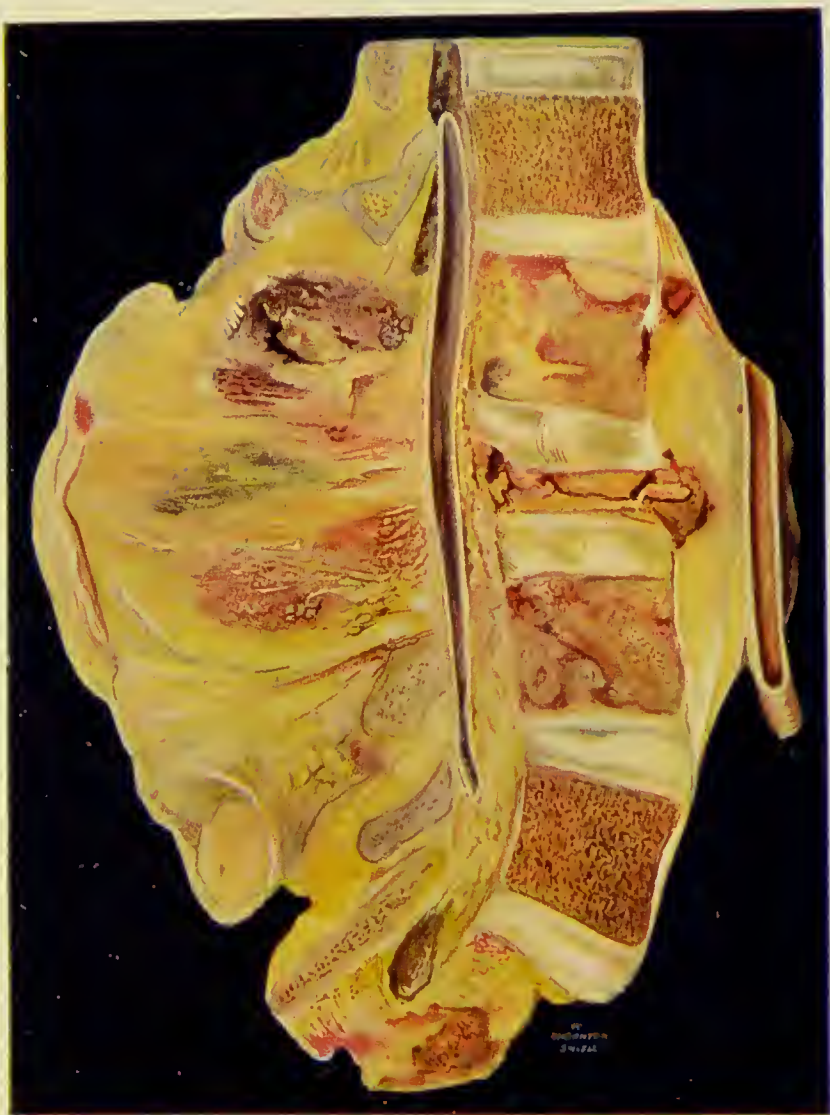


PLATE 12.—SARCOMA INVADING THE SPINAL CANAL.

Although the bodies and spines are extensively destroyed, the intervertebral discs have escaped invasion. The aorta is pushed forwards but not infiltrated. Paraplegia, loss of sensation in the legs, and loss of sphincteric control were complete.

(From a specimen, No. 1,132B, in St. Bartholomew's Hosp. Mus.)

membered that deformity is not always present, even when sarcoma is extensive and far advanced. (5) The patient, instead of improving in health and gaining flesh, as is to be observed in those who are placed at rest for Pott's disease, continues to waste and soon becomes feeble and cachectic.

The following cases will serve as illustrations: A girl of 6 had, as it appeared, clear symptoms of Pott's disease in the cervical region. The head and neck were kept in a fixed position; movement was painful. The child supported her head with her hand, as children do when they have Pott's disease. The spine yielded so that the position became that of wry-neck. Soon a deep-seated elastic swelling appeared in the right suboccipital region, and was regarded as an abscess. This continued to enlarge and soon reached the surface, and when superficial enough for full examination seemed to fluctuate distinctly. When, however, an incision was made, only blood escaped. Subsequently what was obviously a sarcoma rapidly attained a large size, and the child died in about two months. On post-mortem examination the left halves of the three upper cervical vertebræ were found to be almost entirely destroyed, and replaced by new growth.

Dr. Lewis Jones has recorded* a case of which the following is a brief abstract: A girl of 9, admitted under the care of Dr. Gee, with slight albuminuria and a temperature of 101° , had been complaining for a week of pain in her right hip and knee. At first the pain subsided when the child was resting in bed, but soon returned, and she steadily wasted. Seven weeks later she had complete motor paralysis and impairment of sensation in the lower limbs, with ineontinence of urine and fæces, and a bed-sore. Death occurred about four months from the commencement of the illness. On

* *St. Bartholomew's Hosp. Repts.*, xx. 225.

examination after death, all the vertebræ below the fourth dorsal were found infiltrated with sarcoma (round-celled, under the microscope), and there were two or three nodules in the upper dorsal vertebræ. The sacrum was entirely occupied by the new growth. The left ilium also was extensively infiltrated, and a large growth protruded into the left iliac fossa and involved the psoas muscle. The lumbar glands were infected, and there were secondary deposits in the ribs and the first bone of the sternum; the right sterno-clavicular joint was completely disorganised. In this patient no tumour was anywhere perceptible, and there was no angular curvature of the spine. "In fact," Dr. Lewis Jones remarks, "during the period of two months during which her chief symptom was pain in various parts of the body, there was nothing to give a clue to a correct diagnosis." The spinal cord itself was not directly involved in the disease, but the meninges were thickened by growth on the outer surface of the dura mater for two inches in the lower dorsal region. Fig. 104, from a specimen in St. Bartholomew's Hospital Museum, shows a sarcoma, in a youth of 17, involving the bodies and arches of the lower dorsal and upper lumbar vertebræ, which, as it grew, compressed the cord. The earliest symptoms were pain in the right calf and swelling of the knee. Nine weeks from the onset a tender, fluctuating swelling appeared in the right loin, which was followed by rather sudden paraplegia and loss of sphincteric control. A prominence resembling angular curvature was present in the region of the lower dorsal spines. There were tenderness and rigidity in this region, and some febrile disturbance. The lesion was believed to be tuberculous—a presumption strengthened by the tender swelling in the loin. The swelling in the loin was incised, and found to consist of soft sarcomatous material in the substance of the psoas muscle. The patient died

three months from the commencement of his illness. Another specimen (No. 1,130) shows sarcoma of the sixth cervical vertebra, secondary to sarcoma of the uterus, in a woman, aged 22. There were secondary deposits

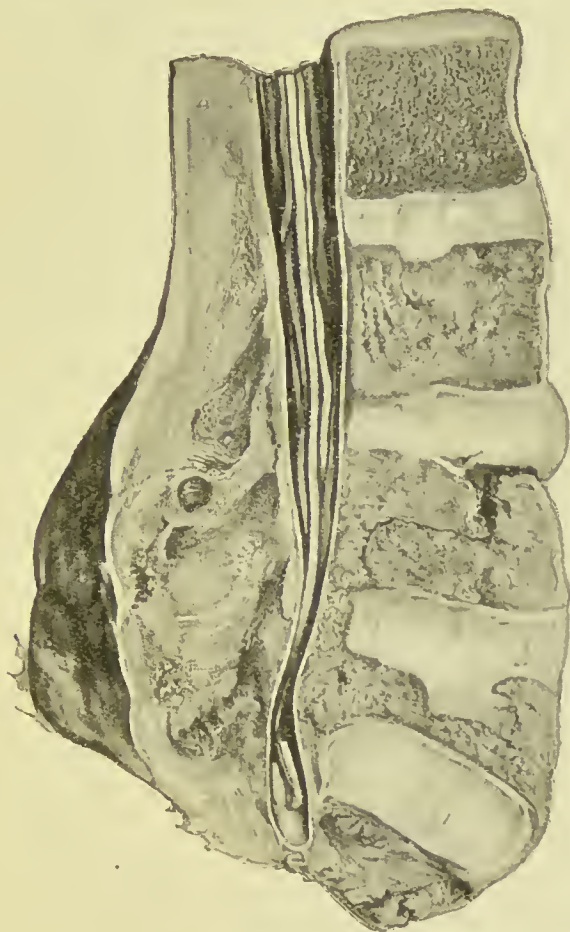


Fig. 104.—Sarcoma of the spinal column in the lower dorsal region, compressing the cord and producing a prominence posteriorly which simulated angular curvature.

(From a specimen, No. 1,132c, in St. Bartholomew's Hosp. Mus.)

also in the lungs and pericardium. The patient had paralysis especially affecting the right arm and leg. The growth projected into the spinal canal, and protruded through the intervertebral foramina.

In the following case, if the history was correct, sarcoma was developed in a spine which was the seat of Pott's disease of long standing. A woman, aged 24, was said to have had curvature of the spine when was 18. She had always been delicate, but she could walk till she was 22. She then moved with difficulty,



Fig. 105.—Sarcoma infiltrating psoas muscle and simulating psoas abscess. The primary growth in the spinal column is shown in Fig. 104.

(From a specimen, No. 1,174D, in St. Bartholomew's Hosp. Mus.)

and complained of pain in her back and sides. When I saw her, two years later, she was lying in bed with considerable deformity of the lower part of the lumbar spine, exactly similar to that produced by the excavation of two or three vertebræ in the course of Pott's disease. In the left iliac fossa was a large, highly elastic and tense swelling, which occupied the position of, and exactly resembled, an iliac abscess. When this swelling was incised, it proved to consist of a large sarcomatous growth.

CARCINOMA

Carcinoma does not originate in a primary form in the spinal column. But when dissemination takes place in carcinoma of the breast, or some other part, the

vertebræ are liable to be the seat of secondary deposits. As long ago as 1841, Mr. Cæsar Hawkins contributed a paper on this subject to the *Transactions* of the Medico-Chirurgical Society. Of the cases he related, twelve in number, one-half followed scirrhus carcinoma of the breast. In one, recorded by Cruveilhier, the primary disease was in the testis. In the St. Bartholomew's Hospital Museum, No. 1,131B shows deposits of carcinoma in the right half of the second, third, fourth, and fifth cervical vertebræ in a case of primary carcinoma of the thyroid gland. No. 1,129 consists of the upper cervical vertebræ of a man, aged 35, who had suffered for eight or nine months from pain in the neck and shoulders, which was attributed to rheumatism. For the previous four or five months an alteration of his gait had been observed; the shoulders were elevated and the neck was shortened. For two months he had been unable to wear a collar. One month before death the limbs and trunk became paralysed. Power in the left arm and leg failed first, and in the course of a few days the paralysis was complete. The urine and fæces were passed involuntarily. The immediate cause of death was paralysis of the respiratory muscles. On examination, the second and third cervical vertebræ were found to be almost entirely destroyed by carcinomatous growth. The seat of primary disease is not mentioned. No. 1,131 (Fig. 106) consists of seven cervical vertebræ from a man who died of scirrhus cancer of the breast and secondary deposits in other organs. Five vertebræ are affected with scirrhus cancer. In the first and last two the cancellous tissue is loaded with the growth, whilst the two intervening vertebræ are almost entirely destroyed. The chief indications of the disease consisted of severe pains like those of rheumatism in the loins and lower limbs. It is not stated whether any paralysis occurred. No. 2,540 shows a soft, brain-like carcinoma, projecting

from the left side of the cervical spine from the fourth vertebra to the sixth. The growth is attached to the posterior surface of the dura mater. A portion of the fourth vertebra is infiltrated and softened. The disease was secondary to carcinoma of the pancreas.

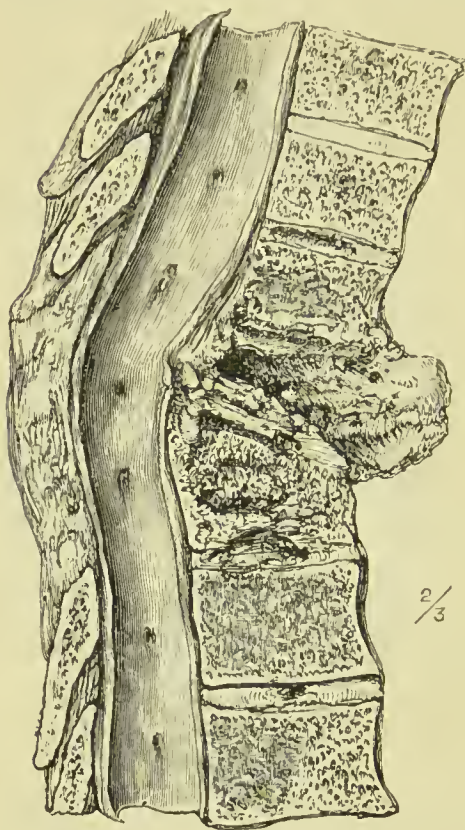


Fig. 106.—Carcinoma of the spine, secondary to carcinoma in a male breast.

(From a specimen, No. 1,131, in St. Bartholomew's Hosp. Mus.)

The patient was a man, aged 46, who came under the care of Dr. Ormerod in July, 1879, complaining of constipation and abdominal pain. He had already had pains in the left shoulder, and in the previous week had lost power in his left arm. This pain and loss of power in the arm increased, and the muscles became atrophied. He had numbness in the fingers, and he quickly lost flesh. Two months later he began to lose the use of his right hand, and complained of pain in the right biceps. In a few days both his legs

became paralysed, and the paralysis extended and became complete in all parts except the right arm. The respiration became embarrassed, and he died in about four months after his symptoms were first observed.

The tumour remained deeply seated, and was not noticed till the post-mortem examination was made.

The changes which occur in the spine in carcinoma are similar to those produced by sarcoma. The bodies of one or several of the vertebræ become infiltrated and softened, and the growth, when it protrudes from within the bone, may be placed in front or on the sides of the bodies, or it may project backwards so as to involve the lateral parts of the neural arches, and fill up and escape from the intervertebral foramina. In this situation it infiltrates or compresses the spinal nerves. Or, projecting into the spinal canal, it infiltrates the membranes and compresses or destroys the cord.

When the lower cervical region is the part involved, paralysis of one arm is often an early symptom. Or there may be paraplegia, with incontinence of urine and feces, and the formation of pressure-sores. In many cases a well-marked angular deformity is produced. This, however, is not by any means always present, even when the disease is far advanced. The affection, like sarcoma of the spine, makes rapid progress. The patient loses flesh and strength, and dies in from three to six months, either of exhaustion, or of lung complications the result of impaired action of the muscles of respiration. In other instances, again, death results from secondary deposits in the lungs, liver, or some of the other viscera.

Malignant disease—whether sarcoma or carcinoma—of the spine may fairly be spoken of as rare. Yet it is not so rare, either in children or in adults, that it can be safely left out of account in the diagnosis of obscure spinal cases. In my experience, angular curvature in persons between forty and sixty is more likely to depend on secondary carcinoma than on tuberculosis, especially in cases in which pain is severe and not materially relieved by rest.

Symptoms.—The recognition of carcinoma of the

spine in the early stages of its development is often very difficult. The chief symptoms to be observed at this period consist of increasing weakness and difficulty of movement, and severe pain, either local or referred to the peripheries of the nerves concerned. The situation in which pain is felt depends upon the level at which the spine is involved, and the degree in which the cord itself, and the spinal nerves, as they issue from the intervertebral foramina, are infiltrated or compressed. But these symptoms of weakness and pain are often vague and inconclusive. In many cases weakness is deceptive, for it may seem to be due to mere loss of general health, and the pains which the patient reports may present no feature in any way characteristic of their spinal origin. In carcinoma, moreover, the fact that primary disease is present may be unknown, for not rarely patients with carcinoma of the breast, for example, are so terrified by their anticipations that they keep the matter to themselves, and, if asked whether they have a swelling, will persist in their denial that any is present. A woman, aged 43, had severe girdle pains round the lower ribs and pain in the spine, with weakness of the legs. The pain was sometimes intense, and she moved with difficulty. Evidently serious mischief was in progress. At first sight the case might have been regarded as one of rapid Pott's disease, but the severity of the symptoms was out of all proportion to the local evidence, for all that could, at this period, be made out was that the spine was stiff; there was no angular deformity. As it was thought—pain being very severe—that possibly a new growth was in progress, the patient was asked if she had any swelling elsewhere, particularly in either breast, but she said that nothing of the kind was present. When further pressed, however, she allowed that she had known of a swelling in the left breast for eleven months. On

examination a far-advanced scirrhus was found, together with extensive enlargement of the axillary glands. A few weeks later, angular yielding of the spine became apparent, and pain, in spite of recumbency, remained very urgent; the right lower limb and, three weeks later, the left became paralysed, and the patient lost control over her bladder and rectum, had large bed-sores, and died, eight months after the first symptoms were noted, from exhaustion.

Further: In regard to diagnosis, it must always be borne in mind that in the early stage of the affection the symptoms of a new growth in the spine are indistinguishable from those of Pott's disease. It is, therefore, only by remembering the possibility that malignant disease may be present, and by studying the collateral as well as the direct evidence, that mistakes can be avoided. A skiagram should, if possible, be obtained.

As to the **treatment of malignant disease of the spine**, there is very little to be said. Palliative measures can alone be adopted. The only position in which the patient can escape severe suffering is that of horizontal rest on a tolerably firm mattress, with pillows arranged to obviate pressure. A poroplastic jacket, soft opposite the curvature, may, by steadying the spine, afford some relief from suffering, and render the necessary movement of the patient less painful. Anodynes must be used, though their amount should be carefully guarded. The hypodermic injection of morphia, sparingly employed, will be required in the later stages of the case.

It may be well to add that the patient should be kept strictly in the recumbent position; for I have met with two instances in which the spine underwent (as may be the case with a long bone involved in a new growth) spontaneous fracture, attended with sudden displacement of the fragments and compression of the cord.

CHAPTER III

SPONDYLITIS DEFORMANS

IN those who are the subjects of arthritis deformans involving the joints of the extremities, the spinal column is often affected also; while in some instances the disease occurs in the spine when all other parts are free. To those cases in which the stress of the disease falls on the spinal column, and in which the peripheral joints either escape altogether or are only implicated in a minor degree, the term "spondylitis deformans" is given. Many observers—notably von Bechterew,* Strumpel,† and Marie‡—have described special varieties of spondylitis deformans which they regard as distinct types. Our knowledge of their morbid anatomy is still very imperfect, but it seems probable that as it increases it will be possible to divide the cases into two main classes, as in arthritis deformans of the joints of the extremities (see p. 144), the hypertrophic or osteoarthritic type, and the atrophic or rheumatoid type.

Rigidity of the spine, accompanied by pain, more especially in the early stages, may occur in the course of an attack of rheumatoid arthritis involving the peripheral joints, and it may also occur as a sequela of many acute infective conditions, such as enteric fever, gonorrhoea, etc. In these instances the arthritis may end in ankylosis, frequently without the marked kyphosis which is so prominent a feature of the osteoarthritic type, and often with a straight and rigid spinal

* Von Bechterew, *Deut. Zeits. f. Nervenheilk.*, 1897.

† Strumpel, *ibid.* ‡ Marie, *Revue de Méd.*, 1898.

column, to which the name of "poker back" has been given. Many similar cases arise without any obvious cause, although a septic focus in the intestinal tract or elsewhere is usually held responsible for their origin (*see p. 131*).

Morbid anatomy.—The structural changes which osteo-arthritis produces in the spine arc, with one remarkable exception, similar to those met with elsewhere, in respect to the wearing away of the articular cartilage, the alteration in the shape of the bones, and the formation of osteophytic outgrowths, with lipping of the articular borders. The feature in which the disease in the spine differs



Fig. 106.—The bodies of the eighth, ninth, tenth and eleventh dorsal vertebræ are firmly united by a strip of compact bone, smooth on the surface, and raised in ridges which roughly correspond to the position of the intervertebral discs.

from all other cases is that it commonly leads to extensive and complete bony ankylosis (Figs. 106 and 107). Fig. 107 shows a spinal column, the seat of osteo-arthritis, in which nearly all the dorsal vertebræ are thus welded together into a solid stem. This change concerns not only the vertebræ themselves, but also the surrounding ligaments. The anterior common ligament is converted into hard bone. Springing from

the borders of adjacent vertebræ are large osteophytes. In some instances these outgrowths are fused together

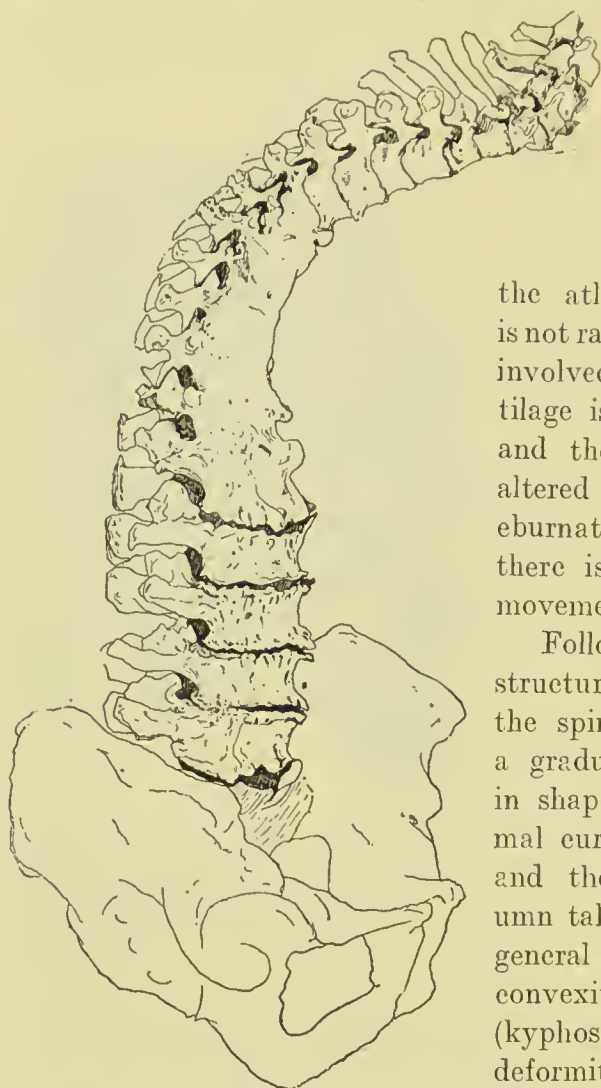


Fig. 107.—Osteo-arthritis of the spine, showing extensive bony ankylosis.

(From a specimen in the Cambridge Museum.)

(Fig. 106); but in others they merely interlock. The joint between

the atlas and axis is not rarely seriously involved. The cartilage is worn away, and the bones are altered in shape and eburnated, so that there is grating on movement.

Following these structural changes, the spine undergoes a gradual alteration in shape. The normal curves are lost, and the whole column takes part in a general bow with its convexity backwards (kyphosis). As this deformity advances and the spine becomes stiff, the patient stoops more

and more, and is at length unable to raise his trunk. In some cases, in consequence of yielding of the cervical spine and stiffness of the joints between the atlas

and axis, the chin rests on the sternum, and the patient can no longer turn his head.

Ultimately, the costo-vertebral joints become ankylosed and the ribs fixed, with the result that breathing becomes entirely diaphragmatic. When this stage is reached, any inflammatory condition of the lungs is very likely to be attended with a fatal result. In some instances the hip-joints also are involved.

Symptoms.—These consist of gradually increasing stiffness of the column, often attended with grating on movement, especially in the cervical region; gradual bowing of the column forwards; and in some instances pain around the thorax in the course of the intercostal nerves, over the back of the pelvis and down the thighs in the course of the great sciatic nerve, and in the occipital region and down the arms when the cervical spine is involved. The pain is, no doubt, produced by pressure on the nerves where they emerge from the intervertebral foramina, although direct evidence of narrowing of these foramina is seldom obtained at autopsies.

Treatment.—This must be similar to that recommended (p. 162 *et seq.*) for osteo-arthritis of the joints of the extremities. A careful investigation should be carried out for any possible source of infection, as, e.g., a urethral infection. Should yielding and forward curvature show a tendency to increase to a serious degree in the cervical region, so that the head droops towards the sternum, instrumental support should be employed, and the patient, when not taking exercise, should be kept in a reclining attitude, with the head thrown backwards and well supported.

CHAPTER IV

NEUROTIC SPINE

FEMALE patients between the ages of 15 and 35 are often met with who complain of pain in some part of the spine, and of inability to undergo active exertion. Their spines are, they state, weak, and ache severely after even slight exercise, or when the sitting position has been maintained for more than a few minutes. They also complain of some particular spot which is tender, and so sensitive that even the pressure of the clothes is distressing or intolerable. This spot is generally over one of the dorsal or lumbar spinous processes, or a little to the side, over the lower part of the erector spinæ. Usually these patients are unmarried, and not seldom obviously neurotic. This group, however, includes also some young male adults, and occasionally patients of both sexes up to the age of 45 or 50. Whenever such symptoms are observed it is necessary to investigate the case with care. It is important to take into account any evidence which indicates that the patient is neurotic; and the larger the neurotic element, the greater the probability becomes that no structural disease is present. This probability must not, however, be mistaken for conclusive proof. The latter can only be obtained when, after critical investigation, the direct symptoms and characteristics of structural disease can be pronounced absent. Obviously the presence of a neurotic element in a case cannot be accepted as any guarantee of the absence of some other morbid condition. The two constituents may, and often do, co-exist. The forms of

structural disease which a neurotic spine may imitate are chiefly tuberculosis, and, though much more rarely, osteo-arthritis.

The evidence on which a conclusion must be formed will be circumstantial and objective. If the case is one of mimicry only, it will be observed that, in spite of weakness and the severe pain of which complaint is made, the patient can do many things which those who have Pott's disease find difficult or even impossible. She can move up and down stairs, stoop, turn in bed, cough and sneeze, with freedom and without complaint. Many, when they are following their own inclinations, are capable of considerable exertion. The things they like are easily done. As to pain, this is either limited to the "tender spot" or it is felt from that point upwards, as high perhaps as the nape of the neck; but it does not extend round the trunk, or occur in the middle line in front, i.e. there is no reference of pain to the peripheries of the spinal nerves. On examining in the region of the spine itself, there will often be a spot of marked hyperæsthesia of the skin. The least pressure over this spot makes the patient not only flinch, but writhe with pain. There is no trace whatever of angular curvature—but there may be some scoliosis—and, in the majority of cases, no trace of stiffness. When the patient—keeping the knees straight—is asked to bend forwards, all the different segments of the spine take their share in the movement: no part is rigid, and the trunk can be bent far backwards without restraint—an almost impossible attitude in Pott's disease. The difficulty of excluding tuberculous mischief is much greater in those instances in which some rigidity of the spine is present; but when the neurotic element is well marked, and when all the other symptoms of tuberculous disease beyond the stiffness are absent, the mimetic nature of the case may be looked

upon as established—pending, however, the possible development of further symptoms at a later period.

Sometimes on examination it is noticed that one or two spinous processes are so prominent that they are out of line with the rest as the patient stands upright. This observation raises a suspicion of angular curvature. Such spinous processes are perhaps covered with thickened dusky and stained skin—appearances produced by friction from the clothes. These prominent spines may have quite recently attracted the patient's attention, and the inference may be drawn that their presence points to deformity in active progress. On making the patient stoop, however, the prominent spines will (if there is no structural disease) fall into line with the rest, and all appearance of irregularity will be lost (p. 568); while, at the same time, it will be noticed that the spine is free from rigidity. It will thus be seen that, in the presence of a single symptom of Pott's disease (i.e. curvature), the surgeon will usually be right in depending on the negative evidence and concluding that mimie-disease only is present. Such cases should, however, be kept under observation.

The history of the onset of the affection varies in different instances. It may be slowly developed without any apparent exciting cause; or it may follow prolonged fatigue, such as that involved in the nursing of a sick relative; or be produced by a fall, a severe strain, or some other kind of local injury. One of the severest examples I have seen occurred in a lady, aged 35, who was highly neurotic, and had for several years complained of almost unbearable pain in her spine and right hip, which had been the seat of tuberculous disease in her childhood, but which had long ago undergone complete repair. In this case a predisposing cause was, no doubt, the weakness following very marked atrophy of the spinal

muscles which had taken place during prolonged recumbency.

Treatment.—The treatment of these cases is often difficult, and the results obtained are in many instances unsatisfactory. Of the true nature of the affection nothing definite can be said. It is important, however, to bear in mind that the symptoms observed do not depend on any structural alteration in the spine itself. The worst cases are those in which there is a family history of insanity, of epilepsy, or of hysteria of an aggravated type. The most favourable cases are those in which the family history is good, and the condition has followed injury, prolonged fatigue, or some severe temporary strain of the nervous system. The treatment must be general and local. It is best to adopt a very hopeful tone, and to indicate that, as no active disease is present, recovery may be confidently expected. A highly important element is that of complete change of occupation and of surroundings. In slight and early cases, removal to the seaside, or to some country district where the climate is dry and bracing, and where rest may be combined with cheerful society, and alternated with moderate exercise, will often be all that is required, and is always advisable. If the patient is anæmic, and menstruation is deranged, the requisite remedies must be applied.

The treatment of the spine itself consists in a good deal of rest in the horizontal or reclining position, and in massage, skilfully used, and never carried to the point of fatigue. It may be applied for half an hour daily, or for a somewhat longer period four times a week. In the generality of instances in which the condition has been provoked by overwork or by injury, and the neurotic element is not largely present, if these three measures of change, rest, and massage are adopted, recovery will ensue. But where the neurotic element

is predominant no improvement may follow, and the patient is very likely to say that she is unable to bear the massage. Sometimes the temporary use of a light poroplastic jacket may be advantageous. It gives support to the spine, and exercises a good influence on the patient's mind. It should, however, not be worn at night, or for more than a few weeks, and while it is employed the patient should be encouraged in the belief that her strength is returning, and massage should, if possible, be used. There are patients in whom it produces a good effect to have a liniment rubbed in over the lumbar region, and over the erector spinæ. In such, the belief or impression that benefit will follow should always be turned to account. In some instances electrical treatment is of service. Such agents as counter-irritation, the hot button, or the actual cautery should not be employed.

In cases that have resisted all treatment, and in which the patient has long been an invalid, spending much of her time in the horizontal position, recovery has followed the diversion of the mind into a new channel. A married lady, aged 34, very highly neurotic, who had previously suffered with a hysterical knee, had been lying down for five months, on account of weakness and severe pain in the lumbar spine whenever she sat up. She also had a spot which was so tender that she could not bear it to be touched. While matters were in this position, and all treatment had failed to give relief, her only child, a boy of 7, developed a severe attack of typhoid fever. In her great mental distress she seemed to forget her spine, and she left her sofa and attended constantly to the child. Unhappily he died. She proved, however, to have shaken off her spinal trouble, and henceforth, in memory of her boy, she employed herself actively in charitable work. In some extreme cases the Weir-Mitchell method has been successful after all other means have failed.

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